# CHAPTER 5
# Meeting and Managing Future Water Demands (2000–2025)

In moving from issue identification/analysis to solution development, several water source options were considered to address the water supply issues identified in **Chapter 4**. Eight water source options were initially identified for consideration in the Upper East Coast (UEC) Planning Area to meet existing and future demands. These options either make additional water available from historically used sources or other sources, such as the Floridan Aquifer, or provide improved management of the sources, such as, conservation. The options considered were (no implied priority):

- Aquifer storage and recovery
- Conservation
- Floridan Aquifer
- Reclaimed Water
- Reservoirs
- Seawater
- Surface water
- Surficial Aquifer

Development of each of these options could be the responsibility of regional and/or local entities.

In this chapter, water resource development and water supply development are defined as applied to implementation of the recommendations of this Plan. Presented are the opportunities and roles of each of the source options in meeting the urban, agricultural and environmental water needs on a regional scale. Each water source option is defined and summarized, providing information on estimated costs to develop that option, the quantity of water potentially available from that option and potential implementation strategies. This information is based mostly on the topics that were discussed at the public workshops. The implementation strategies provide the basis for the recommendations in **Chapter 6**.

## WATER SUPPLY DEVELOPMENT AND WATER RESOURCE DEVELOPMENT

Chapter 373 of the Florida Statutes (F.S.) requires that water supply plans include a list or menu of water source options for water supply development for local water users to choose from. Each water source option listed should provide the estimated amount of water available for use, along with estimated costs, potential sources of funding and a list of water supply development projects that meet applicable funding criteria. In addition,

water supply plans must also include a listing of water resource development projects that support water supply development. Each water resource development project listed should provide an estimate of the amount of water to become available as a result of that recommendation, a timetable, funding and entities responsible for implementation. The estimated amount of water potentially available and the costs to develop that source from a regional perspective are provided in this chapter. Specific recommendations to develop that source option, costs associated with implementation, a timetable, an estimated amount that would be made for use, the entity responsible for implementation and potential funding sources for each recommendation are contained in **Chapters 6** of this Plan.

Section 373.019, F.S. defines water resource development and water supply development as follows:

> "Water resource development" means the formulation and implementation of regional water resource management strategies, including the collection and evaluation of surface water and groundwater data; structural and nonstructural programs to protect and manage water resources; the development of regional water resource implementation programs; the construction, operation and maintenance of major public works facilities to provide for flood control, surface and underground water storage, and groundwater recharge augmentation; and related technical assistance to local governments and to government-owned and privately owned water utilities.

and,

> "Water supply development" means the planning, design, construction, operation and maintenance of public or private facilities for water collection, production, treatment, transmission, or distribution for sale, resale, or end use.

For the purposes of this Plan, it was concluded that the District is responsible for water resource development to attain the maximum reasonable-beneficial use of water; to assure the availability of an adequate supply of water for all competing uses deemed reasonable and beneficial; and to maintain the functions of natural systems. Local users have primary responsibility for water supply development; choosing water source development options that best meet their individual needs. For an option to be a water resource development project, it should:

- Address more than one resource issue.
- Address a variety of use classes (e.g., environment, public water supply).
- Protect/enhance resource availability for allocation.
- Move water from water surplus areas to deficit areas.
- Apply technology on a regional basis.

For an option to be a water supply development project, it should provide:

- Localized implementation of technology.
- Delivery of resource to consumer.

## OPPORTUNITIES AND ROLES

Stakeholders and District staff reviewed the water source options to assess the potential for meeting the water supply needs of the UEC Planning Area. The results are presented in **Table 12**. The table indicates the ability of each option to meet the identified need, except for inland environmental needs. For inland environmental needs, the response shows the ability of that option to reduce demands from the Surficial Aquifer, potentially enhancing nearby natural systems.

The relative ability of each source option in this table was based on regional volumes (supply and demand), and does not universally reflect the publics' sense of importance of that option. For example, significant emphasis was placed on the importance of increased conservation to promote more efficient use of water, although from a regional perspective, the volume of water that could be made available through conservation is low to medium compared to other water source options and the overall need. At the local level, the potential of each option may change based on the specific needs of that local situation. From a volume perspective, options that can significantly (and relatively) make more water available would be scored high. Elements of conservation are incorporated with the use of each of these options.

In **Table 12**, an entry of high (H) indicates the option, based on volume, has a high potential to address the associated category's water supply needs. A medium (M) entry indicates the option has a medium potential, and a low entry means there is low potential to address water supply needs. The high, medium and low entries are relative to one another.

These options are menu items that local water users should consider in meeting their individual water needs. In many cases, several options will be used to meet demands depending on the specific situation.

**Table 12.** Potential of Water Source Options in Meeting 2025 UEC Water Supply Needs.

| Water Source Option | UEC Water Supply Needs | | | | | |
|---|---|---|---|---|---|---|
| | Public Water Supply | Recreational Self-Supply | Agriculture | Thermoelectric Power Generation | Freshwater Needs of Estuarine Systems | Inland Environ-mental Needs[c] |
| Aquifer Storage and Recovery | L | L | L | L | L[d] | L |
| Conservation[a] | L/M | L | L | L | N/A | L |
| Floridan Aquifer System | H | L | M | H | N/A | H |
| Reclaimed Water | L | M | L | H | N/A | H |
| Reservoirs | L | L | M | H | H | L |
| Seawater[b] | L | L | L | H | N/A | L |
| Surface Water | L | L | H | L | H | L |
| Surficial Aquifer System | M | M | L | L | N/A | L |

L=Low; M=Medium; H=High; N/A=Not Applicable

a. Generally cost-effective and although does not yield volumes comparable to other options, is considered highly effective in contributing to long-term, climate-proof resources.
b. Potentially large volume could be made available, but determined not cost-effective at this time.
c. Ability of option to reduce demands from SAS, potentially enhancing nearby natural systems.
d. ASR was not identified as a component in the CERP Indian River Lagoon – South Project.

# WATER SOURCE OPTIONS AND STRATEGIES

Each water source option is discussed to identify its potential for use in the UEC Planning Area. For each water source option, the following information is presented: definition and discussion, estimated costs to develop that option, the quantity of water potentially available from that option and potential implementation strategies.

## Aquifer Storage and Recovery (ASR)

Aquifer storage and recovery (ASR) is the underground storage of injected water into an acceptable aquifer (typically the Floridan Aquifer System in south Florida) during times when water is available, and the later recovery of this water during high demand periods. The aquifer acts as an underground reservoir for the injected water, reducing water loss to evaporation.

In 2002, there were five ASR wells in the District with operations permits using treated drinking water or partially treated surface water. There were 15 ASR wells under operational testing, and over ten wells under construction. There are no ASR facilities in the UEC Planning Area. In addition to these utility uses, the District, in cooperation with

the U.S. Army Corps of Engineers (USACE), is pursuing regional ASR systems as part of the Comprehensive Everglades Restoration Plan (CERP). Almost 400 ASR wells are planned around Lake Okeechobee and other significant sources of water, such as major canals.

### Treated Water ASR

Treated water ASR involves using potable water as the injection water. Since potable water meets drinking water standards, this type of ASR application is more easily permitted. There are many examples in Florida of utilities using treated water ASR, including several in the SFWMD. These include Collier County, Miami-Dade County, Lee County and the City of Boynton Beach Utilities.

### Raw Water or Partially Treated ASR

Raw water or partially treated ASR involves using groundwater from freshwater aquifers or surface water. Some treatment may be necessary prior to injection to meet the appropriate standards. Raw water or partially treated ASR is usually discussed in combination with surface water storage, such as a reservoir or canal system. The reservoir or canal system captures excess surface water and provides sufficient volumes of water for the ASR injection cycle. In lieu of withdrawing surface water directly from a surface water body, potential projects may involve installation of vertical and/or horizontal wells, and use of the soil matrix between the water body and well intake for filtration, sometimes referred to as bank filtration. This type of ASR could be used as a supplemental source to reclaimed water for irrigation use.

### Reclaimed Water ASR

Reclaimed water ASR involves using reclaimed water as the injection water. Several communities in Florida are interested in reclaimed water ASR and are investigating the feasibility of such a system. In 2002, two utilities in the Tampa Area initiated operational testing of ASR systems using reclaimed water. Some modification to treatment systems or installation of additional treatment components may be necessary to meet applicable standards. There are no reclaimed water ASR wells in the SFWMD.

**ASR Wellhead**

### Fate of Microorganisms in Aquifers Study

The SFWMD, in conjunction with others, is conducting a Fate of Microorganisms Study to evaluate the fate of coliform bacteria and other biological constituents (e.g., bacteria, viruses, protozoa) during storage through ASR wells in brackish aquifers. Limited available data suggests that natural bacterial, geochemical and physical processes that occur underground around an ASR may cause rapid die-off of pathogenic microorganisms, particularly in brackish aquifers prevalent in much of the District. Current Florida Department of Environmental Protection (FDEP) interpretations of the Underground Injection Control (UIC) regulations necessitate treatment to drinking water standards to eliminate coliform bacteria in recharge water. If a reasonable case could be made through testing and monitoring that sufficient treatment occurs naturally in the aquifer within a zone around the well, then recharge pretreatment and associated costs could possibly be reduced. Therefore, efforts to confirm and document such underground natural processes are needed to provide a firm foundation for legislative or regulatory actions that would help to achieve these potential cost savings without jeopardizing groundwater quality or public health. A risk-based comparison of potential benefits may then be performed, including consideration of the cost savings to Florida taxpayers and water consumers, and also any potential risks associated with proposed reduction in pretreatment requirements.

The study is being conducted in a phased approach to further investigate the pathogen die-off phenomenon reported via subsurface storage. During Phase I, a literature search was conducted to document existing literature regarding the fate of coliform bacteria and other biological constituents during subsurface storage. Also during Phase I, laboratory experiments were conducted by investigating the effects of varying temperature and salinity values on pathogenic microorganisms. With the recent completion of Phase I in 2004 having generally positive results, the SFWMD is considering conducting in-situ testing in Phase II of the study with a technique known as diffusion chambers. Diffusion chambers allow water to pass through, but the seeded pathogenic microorganisms are retained within the chamber. Therefore, the chambers can be lowered into a well and the effects of subsurface conditions (i.e., aquifer water quality, geochemistry, native microorganisms, pressure, etc.) can be evaluated, while still protecting public health. Should these tests prove successful, a risk-based strategy could be conducted in the future via Phase III to store non-disinfected water in the subsurface. The District is awaiting approval from regulatory agencies regarding the proposed Phase II work. Once approved, a detailed scope of work would need to be developed before Phase II work could commence.

### Aquifer Storage and Recovery – Estimated Costs

Estimated costs for an ASR system depend on the type of the ASR system. Estimated costs for a 2-MGD potable water ASR system and a 5-MGD surface water ASR system are provided in Chapter 3 of the *DRAFT Consolidated Water Supply Plan Support Document*. A 2-MGD drinking water ASR system has an estimated total

construction cost of $990,000 and an annual operations and maintenance cost of $83,300. This equates to a cost of about $0.44 per 1,000 gallons. A 5-MGD surface water ASR system with microfiltration has an estimated total construction cost of $6.54 million and an annual operations and maintenance cost of $364,781. This equates to a cost of about $1.05 per 1,000 gallons.

The potable water cost information assumes the ASR well will be located at the water treatment plant site and have a 70 percent recovery rate. The surface water ASR cost information assumes the ASR facilities will be located at a remote site with microfiltration treatment of the water being injected, and a 70 percent recovery rate.

### Aquifer Storage and Recovery – Quantity of Water Potentially Available

The volume of water that could be made available through ASR wells depends upon several local factors, such as well yield, water availability, variability in water supply and variability in demand. Without additional information, it is not possible to accurately estimate the quantity of water that could be available through ASR. Typical storage volumes for individual wells range from 10 to 500 million gallons per cycle or 31 to 1,535 acre-feet (Pyne, 1995). Where appropriate, multiple ASR wells could be operated as a wellfield, with the capacity determined from the recharge and/or recovery periods. The storage time is usually seasonal, but could be used long-term or for emergency events. The volume of water that could be made available by any specific user must be determined through the District's Consumptive Use Permit (CUP) Program.

### Aquifer Storage and Recovery – Implementation Strategies

The following is a potential strategy developed in cooperation with the public that will be considered in the development of plan recommendations regarding ASR:

- Utilities should explore ASR, among other options, to extend the use of current resources in order to meet future demands, including addressing peaks in demands or in availability of resources. Aquifer storage and recovery could be used to extend water supplies during peak demand periods.

## Conservation

The overall water conservation goal of the state is to prevent and reduce wasteful, uneconomical, impractical or unreasonable use of water resources, pursuant to Section 62-40.412, of the Florida Administrative Code (F.A.C.). As an alternative to the development of new water supply, water conservation programs can provide additional water from traditional sources, usually at a lower cost. The least-expensive water is the water that utilities have already developed.

In this section, conservation refers to long-term reductions that generally result from implementation of water saving technologies, such as ultralow flow plumbing,

irrigation rain sensors and water pricing strategies that encourage efficient water use. This is in contrast to short-term water conservation measures and cutbacks made by users during water shortage situations.

The 1998 UEC Water Supply Plan (1998 Plan) concluded that historically used sources of water, primarily fresh groundwater sources, are not sufficient to meet the projected demands through the planning horizon. The 1998 Plan recommended new sources of water be explored and used, including the Floridan Aquifer System (FAS). Increased use of reclaimed water and increased water conservation and research was recommended to meet the projected demands and to reduce the potential for harm to wetlands and water resources. The Plan also recommended more efficient use of water by increasing urban and agricultural water conservation and developing cost-sharing partnerships. Since 1998, the District has supported mobile irrigation labs in the planning area and has educated the region's water users through water conservation outreach and education programs provided by the SFMWD Martin/St. Lucie Service Center.

Conservation is vitally important for the fast-growing UEC Planning Area. Population in the region is projected to increase by about 50 percent from 2000 to 2025. More and more, water conservation is being regarded as an important component in integrated water resource management. In addition to offsetting demands on traditional water resources and reducing impact on natural systems by developing alternative water supplies, such as desalination, ASR and reclaimed water for reuse, water conservation or demand reduction, has become a factor in managing water resources. Measures to use water more efficiently can be less expensive than projects to increase supply and have other important advantages, such as reducing stress on natural systems. Water saved can be used to meet new needs, in effect expanding current water supplies and protecting the environment. In addition to environmental benefits and augmenting water supplies, water conservation projects are often easier to implement than supply projects due to uncomplicated permitting, lower costs and acceptance by the public.

## Evaluating Conservation in the Water Supply Planning Process

Statewide, in concert with the FDEP, water management districts agreed to conduct evaluations of water conservation in the water supply planning process. Water conservation is regarded as a potential source of supply, and as such, estimates of supply are performed through evaluation of data and potential best management practices. These evaluations include an assessment of water conservation opportunities in the planning area and potential measures for improving water use efficiency, assessment of the measures determined to be the most feasible and programs to implement the alternative(s). Recommendations include funding sources, responsible parties and timetables. Potential for water conservation measures can be found in each of the following sectors:

1. Agricultural Irrigation
2. Landscape Irrigation
3. Water Pricing
4. Industrial/Commercial/Institutional
5. Indoor Water Use
6. General Policy Considerations

This process, including the sectors, is an outgrowth of the Florida Water Conservation Initiative completed in 2002. This state initiative was spurred by Florida's rapidly growing population and recent experience of one of the worst droughts in state history. The initiative developed and ranked a series of conservation recommendations. The information presented in this conservation section is organized based on the previously stated sectors. The state water conservation initiative is explained in greater detail next.

### A Statewide Effort: Florida's Water Conservation Initiative

In response to growing water demands, water supply problems and one of the worst droughts in Florida's history, the FDEP led a statewide Water Conservation Initiative (WCI) to find ways to improve efficiency in all categories of water use. Hundreds of stakeholders participated in the WCI, which addressed all water use classes, and subsequently offered alternatives to save water. Fifty-one cost-efficient alternatives were published in the document entitled *The Florida Water Conservation Initiative* (FDEP, 2002a). A full list of the 51 alternatives may be found in Chapter 3 of the *DRAFT Consolidated Water Supply Plan Support Document*. In addition to policy and regulatory measures, the following six alternatives were the highest-ranked of the WCI alternatives:

*Agricultural Irrigation* presents many opportunities for improved efficiency. Key among these are cost-share programs to implement irrigation best management practices, increased use of mobile irrigation labs to evaluate irrigation efficiency, improvements in the recovery and recycling of irrigation water and greater use of reclaimed water for irrigation.

*Landscape Irrigation* for watering lawns, ornamental plants and golf courses can be significantly reduced through more efficient irrigation system design, installation and operation, and by reducing the amount of landscaping that requires intensive irrigation.

*Water Pricing* or rate structures, informative utility billing and other techniques can send appropriate price signals to encourage water users to conserve water.

*Industrial, Commercial and Institutional* users can improve water use efficiency through certification programs for businesses that implement industry-specific best

management practices, and through water use audits, improved equipment design and installation and greater use of reclaimed water.

*Indoor Water Use* is a growing water use sector. The greatest potential for conserving water in this sector is through increasing the number of Florida homes and businesses that use water-efficient toilets, clothes washers, showerheads, faucets and dishwashers.

*Reuse of Reclaimed Water* can be used more efficiently through pricing and metering. Metering of reclaimed water use and implementation of volume-based rates for reclaimed water is a major strategy contained in the *Water Reuse for Florida – Strategies for Effective Use of Reclaimed Water Report* to promote efficient use of reclaimed water (Reuse Coordinating Committee, 2003).

A comprehensive, statewide water conservation effort has been initiated to implement the recommendations of the WCI including incorporation of conservation into the water supply planning, regulatory and utility facilities planning processes. The public water supply recommendations of the WCI are being pursued through an agreement among key water supply partners in the state.

### Comprehensive Water Conservation Program

To best implement the recommendations of the WCI concerning public water supply, a Joint Statement of Commitment was developed. The agreement outlines the responsibilities of the state, through FDEP, in overseeing a statewide comprehensive water conservation program, as well as the roles of the water management district and utilities. The overarching goal of the entire effort is to produce a statewide program consisting of measurable, accountable and goal-based conservation activities appropriate for each utility's user profile.

The "Joint Statement of Commitment for the Development and Implementation of a Statewide Comprehensive Water Conservation Program for Public Water Supply" (JSOC) is a written agreement by key water supply partners in Florida to collaborate on measures to improve water use efficiency. A copy of the "Joint Statement of Commitment" may be obtained from the Florida Department of Environmental Protection Office of Water Policy available from: http://www.dep.state.fl.us/water/waterpolicy.

Improved water conservation will benefit all water users, both economically and environmentally, and will also help to ensure the sustainability of Florida's water resources. Allowing public water supply utilities the flexibility to tailor cost-effective, goal-based, accountable and measurable water conservation programs to reflect individual circumstances will result in greater water use efficiency.

The signatories of the Joint Statement are the Florida Department of Environmental Protection; the South Florida Water Management District; the St. Johns River Water Management District; the Southwest Florida Water Management District;

the Northwest Florida Water Management District; the Suwannee River Water Management District; the Florida Public Service Commission; the Utility Council of the American Water Works Association, Florida Section; the Utility Council of the Florida Water Environment Association; and the Florida Rural Water Association.

Based on the principles of the Joint Statement, the signatories are now developing a work plan with specific tasks, interim milestones, completion dates, cost estimates and assignments of responsibilities. The work plan is to be completed by February 2005 and will include recommendations for:

- Developing standardized definitions and performance measures for water conservation data collection and analysis.
- Establishing a clearinghouse for water conservation that will provide an integrated statewide database, technical assistance capabilities and continual assessment of the effectiveness of water conservation programs and practices.
- Developing and implementing a standardized water conservation planning process for utilities.
- Developing and maintaining a Florida-specific water conservation guidance document.
- Implementing pilot applications of various elements of the program, or the entire program, through cooperative agreements with volunteer utilities.

### 2004 Legislation

During the finalization of this Plan, legislation was passed incorporating and codifying the development of the statewide water conservation program for public water supply. The bill provides goals that must be addressed as part of the program, encouraging conservation by utilities. One important part of the program requires development of a water conservation guidance manual designed to assist utilities as they implement their specific water conservation plans to satisfy water management district requirements for consumptive use permits. Other aspects of this legislation address guidelines for Xeriscape™ landscaping and development of a model ordinance to be used statewide to increase landscape irrigation efficiency. In addition, the new legislation allows water management districts to require the use of reclaimed water, if feasible, and to encourage metering of newly implemented reuse projects, enabling utilities to charge for actual volumes used. The requirements in this legislation will be addressed during the implementation of this Plan.

### Assessing Water Conservation Opportunities in the UEC Planning Area

The initial assessment of water conservation opportunities in the planning area began with staff considering all 51 recommendations of the WCI. The second step of the assessment was to determine the highest-ranked most applicable and implementable

alternatives. Alternatives that may have been ranked highly by the WCI, but were outside the scope of this water supply plan or the District's authority to require, assist or fund, were not analyzed. For example, high-efficiency kitchen appliances are activities more suited to implementation by utilities and local governments. The complete evaluation of all of the WCI recommendations can be found in Appendix E. The initial assessment considered the six water conservation sectors outlined previously in this section.

**Agricultural Irrigation.** Agricultural irrigation is the largest water use category in the UEC Planning Area. There are several potential water conservation opportunities in agricultural conservation, including irrigation system conversion, water table management and other best management practices. The existing agricultural mobile irrigation laboratory plays an important role in facilitating more efficient use of water within agriculture.

**Landscape Irrigation.** Landscape Irrigation includes statewide standards for landscape irrigation and includes the development and adoption of standards, with inspections, and is the responsibility of the state, under the Florida Building Code. Educational and outreach programs on water efficient landscaping are conducted by the Cooperative Extension Services of the University of Florida, Institute of Food and Agricultural Sciences (IFAS).

Xeriscape™

The District is a funding partner of IFAS research for determining water needs of woody ornamental plants. This research, started in 2003, will provide important data for establishing water shortage restrictions and for establishing water budget recommendations, as cited in the Florida WCI Report. In addition, House Bill 293 (2004 Legislature) will require a statewide program to develop and implement Xeriscape™ landscape irrigation standards for design, installation and operation. The District will participate in this process and work with local governments to adopt a consistent ordinance, which will ensure efficiency in urban irrigation systems.

**Water Pricing.** Water conservation rate structures have been required by SFWMD rule since 1993. The District's consumptive use permitting process for water utilities requires water conservation-based rates. Recent water conservation legislation (HB293) precludes water management districts from setting rates. All the planning region's utilities employ a conservation-based rate structure in their pricing. A statewide study funded by Florida's water management districts was initiated in 2003 to evaluate the effectiveness of the rate structures currently employed by utilities. In addition to analyzing the impact of conservation-based water pricing on revenues, the study will analyze the effect of these rate structures

on water use; participating utility customers will be surveyed. The study is scheduled for completion in 2005.

**Industrial/Commercial/Institutional.** Industrial/Commercial/Institutional water use in the UEC Planning Area represents a minor portion of the overall demand, and in the initial assessment, was not considered significant enough to warrant detailed evaluation.

**Indoor Water Use.** Indoor water use accounts for a major portion of demands on public water supply. Plumbing retrofit programs were one of the WCI's highest-ranked alternatives and were recommended in the 1998 Plan. This alternative is assessed in detail in the Indoor Water Use section of this chapter, using specific data for each county in the UEC Planning Area.

**General Policy Considerations.** The role of education and outreach programs and the effect of cooperative funding programs, such as mobile irrigation labs and other agricultural irrigation programs were reviewed to assess the potential for water conservation in the UEC Planning Area. The District's permit requirements were also considered for conservation and technology-based conservation cost-shares for projects that increase water efficiency.

Education and Outreach. Each of the sectors of water use has necessary outreach and education components. Although quantification of a specific amount of water saved as a result of an outreach and education effort is not as readily measured, as with water saving devices or technology, outreach and education are crucial to any successful conservation program.

Comprehensive outreach and education programs usually involve three steps: awareness, education and adoption of action. *Awareness* is the process of conveying to users an awareness of their behavior (i.e., water use), and communicating the importance of conserving the resource. The next step, *education*, consists of providing appropriate information to users to enable them to understand that taking an action or embracing a concept will result in water savings and/or other benefits. The last step, *action*, results when the user is aware and educated and is actively seeking a solution to conserve. This final step prepares users for technology-based alternatives.

Successful outreach and education efforts usually consist of cooperation between many agencies and organizations. For example, outreach through school education can provide the basis of long-range acceptance and action of the conservation message by future generations. Public water supply utilities can play an important role through their customer service and billing processes. The District and the other participating state agencies have consistently provided assistance to the wide range of water users through outreach and education programs.

Mobile Irrigation Laboratories. Mobile Irrigation Laboratories (MILS), specialized labs on wheels, provide recommendations to improve irrigation systems, and are discussed in greater detail later in this chapter. Irrigation labs are excellent examples of cooperative funding partnerships, often involving federal, state and local entities, which also provide education and outreach.

Agricultural Irrigation Cost-Sharing Programs. Cost-Share Incentive was a highly ranked alternative by the WCI stakeholders. Traditionally, agricultural cost-share incentives have been funded through state and federal agencies (e.g., Florida Department of Agriculture and Consumer Services and the U.S. Department of Agriculture – Natural Resources Conservation Service). Example programs include agricultural irrigation system retrofits employing efficient technologies.

Water Savings Incentive Program (WaterSIP). The SFWMD provides cost-share funding for programs that employ devices to increase water savings. The Water Savings Incentive Program (WaterSIP) was established in Fiscal Year (FY) 2002 to provide funding for projects that conserve water. The WaterSIP focuses on projects that are not capital improvements, such as installing automatic shutoff devices for irrigation systems and plumbing retrofits. To date, the WaterSIP has committed a total of $700,000 in cooperative funding for 19 projects. The program is Districtwide, and will save hundreds of thousands of gallons of water each day. For example, the eight projects funded in FY 2003, once installed, will save an estimated 171 million gallons per year (MGY). Projects are identified for funding through a Request for Proposals solicitation and project selection process. In addition to public water suppliers, other entities wishing to cost-share in water saving programs are eligible, such as homeowner's associations and public/private partnerships. There have not been any WaterSIP proposals submitted in the UEC Planning Area through FY 2004, although several regional proposals are currently being recommended for funding in the FY 2005 budget.

Projects that are identified through the evaluation of water conservation alternatives that present the best opportunity for water savings for the UEC Planning Area will likely score higher in the proposal criteria for the WaterSIP. The District also provides cost-share funding for utilities and local government outreach and education activities. The SFWMD's Regional Service Centers provide coordination and education for outreach projects for the general public or specific use sectors.

The WaterSIP is separate from Chapter 40E-2, F.A.C. and the *Basis of Review for Water Use Permit Applications,* which is currently under rulemaking to support goal-based water conservation programs for utilities. Under the proposed rule, a utility would submit a comprehensive water conservation program plan, which commits to conservation measures that may be partially

funded under the criteria guidelines of both the WCI and WaterSIP.

Regulatory Measures. The SFWMD water use permitting rule amendments adopted in January 1993 require specific water conservation elements for public water supply utilities (and associated local governments), commercial/industrial users, landscape and golf course users and agricultural users. The requirements are summarized in **Table 13**. These requirements must be addressed to obtain individual water use permits. For more information on regulatory water conservation measures, please refer to the *DRAFT Consolidated Water Supply Plan Support Document* (SFWMD, 2004b).

Consumptive use permitting requires a leak detection and repair program for any utility with more than 10 percent unaccounted for water.

In addition, 2003 revisions to the *Basis of Review for Water Use Permit Applications* requires all permittees with a maximum monthly allocation of greater than 3.0 million gallons in the UEC Planning Area to monitor and report withdrawal quantities from each withdrawal facility or point of diversion upon renewal of their water use permit. Proper accounting for water use is essential to establish reasonable-beneficial use of the resource, which is in the interest of the public. In addition, proper accounting of various water uses enables the District to better estimate water use and to implement water shortage plans. At this time, many of the irrigation permits in the planning area are going through a renewal process, which should be completely by the end of 2004. A better understanding of actual water use will also assist in identifying potential water conservation opportunities.

Rulemaking efforts are underway at the District to consider goal-based conservation as a permit condition. In 2002, workshops were held in the UEC Planning Area, as well as others, concerning revisions to Chapter 40E-2, F.A.C., and the *Basis of Review for Water Use Permit Applications* to require goal-based conservation programs developed by individual water utilities. Goal-based conservation allows utilities to achieve a water management district agreed-upon conservation goal, such as a reduction in per capita or overall reduction in pumpage, using any method from a suite of methods the utility chooses, to satisfy consumptive use permitting conservation requirements. These programs would be in addition to the existing requirements discussed in the next section.

**Table 13.** Regulatory Conservation Measures.

| Public Water Supply Utilities | Commercial/ Industrial Users | Landscape/ Golf Course Users | Agricultural Users |
|---|---|---|---|
| 1. Adopt irrigation hours ordinance<br>2. Adopt Xeriscape™ landscape ordinance<br>3. Adopt ultralow volume fixtures ordinance<br>4. Adopt rain sensor device ordinance<br>5. Adoption water conservation-based rate structure<br>6. Implement leak detection and repair program<br>7. Implement water conservation public education program<br>8. Analyze feasibility of reclaimed water | 9. Audit water use<br>10. Implement cost-effective conservation measures<br>11. Implement employee conservation awareness program<br>12. Develop an implementation plan<br>13. Analyze feasibility of reclaimed water | 14. Use Xeriscape™ for new and modified projects<br>15. Install rain sensor devices or switches<br>16. Irrigate between 4 p.m. and 10 a.m. only<br>17. Analyze feasibility of reclaimed water | 18. Use microirrigation for new and existing systems<br>19. Analyze feasibility of reclaimed water |

## Detailed Evaluation of the Most Feasible Alternatives – UEC Water Supply Plan

As stated earlier, the 1998 UEC Water Supply Plan recommended plumbing retrofits for both interior plumbing fixtures and rain sensors for automatic landscape irrigation systems; continuation/expansion of the MIL Program; and voluntary conversion of agricultural seepage irrigation systems to microirrigation in the UEC Planning Area. Based on consensus from stakeholders and the analysis associated with this Plan, it was concluded that the 1998 Plan recommendations remain valid and should continue to be implemented.

As previously mentioned, the recommended options were selected from the WCI list of potential conservation measures. These are the methods best suited to the scope of the regional water supply plan. Options with the greatest potential water savings were identified; relevant information was assembled, such as laws, ordinances and District rules, and age of housing stock in the UEC Planning Area were considered and analyzed. An analysis of potential conservation water savings was performed. Funding mechanisms for the recommended alternatives are also discussed in this section.

## Agriculture Irrigation Conservation

Citrus is the dominant crop in the UEC Planning Area. Over 80 percent of the citrus acreage in the planning area is now using low-volume technology or microirrigation as compared to 71 percent in 1998, the remaining acreage uses flood irrigation. Much of the acreage currently using flood irrigation is located in Chapter 298 Districts (Chapter 298, F.S.) where several growers use a method of rain harvesting which recycles water after each use and moves it from one citrus grove to another. Conversion of citrus acreage now using flood irrigation to microirrigation will continue to increase water savings

From a local perspective, additional water harvesting can be achieved from on-site stormwater management systems that capture rainfall for irrigation use. From a regional perspective, the CERP Indian River Lagoon – South Project incorporates regional scale reservoirs in the UEC Planning Area to capture rainfall from the regional canal system that would otherwise flow into the St. Lucie River and Indian River Lagoon Estuary. The primary purpose of the regional reservoirs is to attenuate discharges from the regional canal system to reduce water quality impacts to the estuary. A secondary benefit of the regional reservoirs is increased surface water availability in the planning area.

Citrus Groves in UEC

Since 1992, the U.S. Department of Agriculture – Natural Resources Conservation Service (USDA–NRCS) and the Indian River Lagoon Mobile Irrigation Lab have been promoting water conservation through conversion of flood irrigation systems to low-volume technology. The USDA–NRCS has facilitated these conversions by cost-sharing, using the Environmental Quality Improvement Program (EQIP). In 2003, over 80 percent of citrus acreage in the region has been converted.

In 2004, the District responded to a request from IFAS to become a funding participant in the Florida Automated Weather Network (FAWN). This network of weather stations provides real-time and historical data to water users (agricultural, as well as urban landscape) for making informed irrigation decisions.

## Agricultural Best Management Practices (BMPs)

The Best Management Practices (BMP) Program was developed to help farmers improve water quality. The BMP programs are voluntary, developed in cooperation with specific agricultural commodity groups. The commodity groups that presently have BMP programs in place or under development are Cattle, Citrus (Indian River area and Ridge

area), Green Industries (landscape, nurseries and golf courses), Horses, Silviculture (forestry) and Vegetables.

The statewide BMP Program is authorized by Section 403.067, F.S. and the specific authority for the Indian River Citrus BMP Program in Rule 5M-2, F.A.C. Section 403.021, F.S, mandates SFWMD involvement in the BMP Program.

The Indian River Area Citrus BMP is the most significant program in the UEC Planning Area. Examples of BMPs for the Indian River Area Citrus include scheduling of irrigation and drainage, monitoring of soil moisture and water table management. There has been a high level of enrollment in the voluntary program in the UEC Planning Area. **Table 14** shows the percentage of citrus acres enrolled in the program by county.

**Table 14.** Percent of Citrus Acreage Enrolled in the Indian River BMP Program in the UEC Planning Area.

| County | Potential Acres[a] | Enrolled Acres | Percent Enrolled |
|---|---|---|---|
| Martin | 44,746 | 33,576 | 75% |
| Okeechobee[b] | 12,170 | 9,349 | 77% |
| St. Lucie | 98,889 | 93,272 | 94% |
| Total | 155,805 | 136,196 | 87% |

Source: Florida Department of Agriculture and Consumer Services (FDACS) Notice of Intents Status Reports, 2003.
a. Florida Agricultural Statistics Service data.
b. Includes all of Okeechobee County.

One of the major incentives to join the program is a cost-sharing arrangement with Florida Department of Agriculture and Consumer Services (FDACS) on implementation costs.

Several state, federal and local agencies are involved in the program. The BMP program is administered by FDACS. The FDEP sets allowable pollution limits called Total Maximum Daily Loads (TMDLs) for nutrients. Resource Conservation and Development Corporations and Soil and Water Conservation Districts provide local support for BMP programs. The University of Florida IFAS evaluates individual grove owners' BMP compliance and has written the *Water Quality/Quantity BMPs for Indian River Area Citrus Groves*. The USDA–NRCS provides technical assistance and some additional cost-sharing for the program. The SFWMD provides financial and technical assistance for the program startup.

### Mobile Irrigation Lab Program

The Mobile Irrigation Lab (MIL) Program began in south Florida in 1989 with an agricultural lab on the Lower West Coast. The mission of the labs is to demonstrate and educate agricultural and urban water users on how to irrigate efficiently. There are currently nine labs operating in 11 of the 16 counties within the SFWMD boundaries.

Funding is a multi-agency partnership between federal, state, regional and local levels of government. The agencies currently funding MILs are the USDA–NRCS, the SFWMD and the SFWMD's Big Cypress Basin Board, various Soil and Water Conservation Districts, the FDACS and various county and local governments. Over the past four years, recommendations for improvements to irrigation systems have yielded average annual potential water savings of 3.35 billion gallons per year. Plans to start additional labs within the District's boundaries are underway.

In the UEC Planning Area, there are two urban labs, one in St. Lucie County and one in Martin County. There is also an agricultural lab that provides evaluations in both St. Lucie and Martin counties. The St. Lucie County urban lab has been in operation since 2000. The urban lab in Martin County has been in operation since 1998. Together, these urban labs have saved about 370 MGY since their inception. The agricultural lab has performed evaluations since 1992; since 1998, the lab has saved 2,367 MGY.

## Urban Water Conservation

Utilities in the UEC Planning Area have promoted water conservation through traditional methods, such as public outreach and customer information. The utilities in this region have implemented CUP Program water conservation requirements as previously described, resulting in implementation of water conservation programs and adopted conservation ordinances.

Several utilities have conducted small-scale retrofit projects. In this Plan, a more detailed analysis of supplementary water conservation practices/projects will be discussed to offer recommendations to expand efforts of the region's water suppliers.

The approach to evaluating the best conservation measures for the UEC Planning Area was an iterative one. The evaluation process entailed identifying characteristics of the planning area, such as age of housing stock, that would likely determine the type or respective age of technology of indoor plumbing devices, and characterizing use patterns by service area and per capita trends (**Table 15**).

**Table 15.** Examples of How Alternatives are Evaluated.

| Planning Area Housing Characteristic | Best Opportunity | Conservation Measure |
|---|---|---|
| Indoor - older housing with inefficient indoor plumbing fixtures | Retrofits | Plumbing (e.g., toilets, showerheads, etc.) |
| Outdoor - irrigation systems that do not respond to rainfall | Retrofits | Rain shut-off switches |
| New development | Local ordinances/ codes/regulatory measures | Varies from code enforcement to landscape technology, such as Xeriscape™ |

## Indoor Water Use

Two significant changes occurred in plumbing standards in 1983 and 1994, which affected residential water use. In 1983, Chapter 553, F.S., was modified, lowering the maximum allowable flow rates for water fixtures in new construction to a maximum use of 3.5 gallons per flush for toilets and a flow rate of 3.0 gallons per minute (GPM) for showerheads. Prior to this state legislation, the typical volume of water for toilet flushing was 6.0 gallons and showerhead flow was 6.0 GPM.

In 1994, new plumbing standards for water use were implemented under the Federal Energy Policy Act of 1992, setting national plumbing code standards of 1.6 gallon per flush for toilets, 2.5 GPM for showerheads and 2.0 GPM for faucets.

### *Methodology*

In order to determine urban areas with the greatest potential for retrofits in the UEC Planning Area, a housing stock analysis was performed using age of housing as a determinate of the age and water use characteristics of plumbing fixtures. County property assessors parcel data for Martin and St. Lucie counties provided the number and age of residential units.

To determine housing with greater potential for indoor retrofits, age of the residential units was compared to years when the plumbing code changed as described previously (pre-1984, 1984–1994, 1994–2000). **Table 16** shows the number of units and percentages of housing in each group for Martin and St. Lucie counties.

**Table 16.** Age of Housing Stock in Martin and St. Lucie Counties (Indoor Retrofit).

| County | Housing Stock | | | |
|---|---|---|---|---|
| | Pre-1984 | 1985-1994 | Post-1994 | Total |
| Martin | 25,435<br>59% | 14,250<br>33% | 3,717<br>8% | 43,402 |
| St. Lucie | 30,844<br>49% | 24,474<br>39% | 7,561<br>12% | 62,879 |
| Totals | 56,279<br>53% | 38,724<br>36% | 11,278<br>11% | 106,281 |

### *Costs and Savings*

Utilities that would benefit most from plumbing fixture retrofits are those with significant housing in the pre-1984 age category, and thus, have the most potential for indoor water savings.

In Martin County, ten of 16 utilities had a majority of housing stock in their service areas that was older than 1984. For the remaining six utilities, the majority of housing stock in their service areas was older than 1994. In St. Lucie County, four of nine

utilities had a majority of housing stock older than 1984. A complete listing of housing stock by age and utility service area can be found in Appendix E.

Water savings derived from retrofitting pre-1984 housing to current standards is 4.4 gallons per flush for toilets, and 3.5 GPM for showerheads. Toilets are estimated to be flushed five times a day, with ten minutes per shower as a standard estimate. According to the 2000 U.S. Census, number of persons-per-household was 2.23 in Martin County and 2.47 in St. Lucie County.

Therefore, annual savings from retrofitting one unit from the pre-1984 technology to current standards would be 32,000 gallons for each retrofitted showerhead and 20,075 gallons for each retrofitted toilet.

For the purposes of this approach, it is assumed that a retrofit program would include 75 percent of the pre-1984 housing stock. This percentage is typically used as an estimate of expected coverage in an urban retrofit program, as some retrofits have already been done, some units are vacant or on the market, or for other reasons will not be part of the program. Using the county housing age data in **Tables 16** and **17**, and assuming the 75 percent retrofit, the total potential annual savings of a showerhead retrofit is 1.7 MGD for Martin County and 2.0 MGD for St. Lucie County for a total of 3.70 MGD for the planning area.

Similarly, using the housing age data in **Tables 16** and **17**, and assuming the 75 percent retrofit, total annual savings of a toilet retrofit for Martin County is 1.0 MGD and 1.3 MGD for St. Lucie County, for a total potential savings of 2.3 MGD for the planning area.

Total annual savings for both toilet and showerhead retrofit is 2.7 MGD for Martin County and 3.3 MGD for St. Lucie County for a total potential savings of 6.0 MGD. This estimate assumes one retrofit of each device per housing unit.

Costs for toilet retrofits are $200 per retrofit, and $20 per showerhead, as described in the *DRAFT Consolidated Water Supply Plan Support Document*. Water conservation cost-efficiency is expressed in 1,000 gallons of water saved annually. Toilet retrofits cost $.25 per 1,000 gallons of water saved, and showerhead retrofits cost $.06 per 1,000 gallons of water saved.

Whenever indoor water use is reduced, there is also a reduction in wastewater. Wastewater flows have been estimated to be as much as 50 percent of residential water use. Impacts to wastewater treatment facilities and the need for expansion and disposal can be reduced if water use is reduced.

## Landscape Irrigation

### *Methodology*


Rain Sensor

For this evaluation, water savings derived from installation of rain sensors for housing stock built prior to 1992 is estimated. Based on the county housing age data in **Tables 16** and **17**, and assuming 75 percent of the housing units are retrofitted, a total savings of 5.0 MGD was estimated for the planning area (2.1 MGD for Martin County and 2.9 MGD for St. Lucie County).

Installing rain sensors in irrigation systems of housing units constructed prior to the 1991 Xeriscape™ Landscaping law would result in the greatest savings. For those systems using reclaimed water, additional efficiencies can be realized using metering. Data for **Table 17** were obtained from county property assessors parcel data as previously described. A complete listing of housing stock by age and utility service area can be found in Appendix E.

**Table 17.** Age of Housing Stock in Martin and St. Lucie Counties (Rain Sensor).

| County | Housing Stock | | |
|---|---|---|---|
| | Pre 1992 | Post 1992 | Total |
| Martin | 37,920<br>87% | 5,482<br>13% | 43,402 |
| St. Lucie | 52,540<br>84% | 10,339<br>16% | 62,879 |
| Total | 90,460<br>85% | 15,821<br>15% | 106,281 |

To determine housing with the greatest potential for outdoor retrofits, age of the housing unit was compared to the law related to rain sensor changes (pre-1992 and post-1992). The percentages of units constructed in the two time periods are described for each county. A 1987 SFWMD Survey of Water Use indicated that 70 percent of all residential irrigation in the District is done by in ground automatic irrigation systems, which are required to have a rain sensor as reflected in the law.

### *Costs and Savings*

Rain sensors can provide a significant reduction in water use for nominal cost. The cost is estimated to average $68 per rain sensor including installation, and can save 27,000 gallons per year. This equates to a cost of $0.25 per 1,000 gallons. The useful life

of a rain sensor is estimated to be 10 years. Areas benefiting the most from a rain sensor retrofit program would be pre-1994 housing units with in-ground irrigation systems.

### Urban Mobile Irrigation Labs

In the UEC Planning Area, there are two urban labs, one in St. Lucie and one in Martin County. Mobile irrigation lab personnel evaluate the effectiveness of irrigation systems and then make recommendations on how the system can be made more efficient. The result is savings in water, energy, time and money for the user.

## Conservation – Quantity of Water Potentially Available

**Table 18** highlights three examples of public water supply utility characteristics, and a culling of the best-fit water conservation measures recommended for each utility area characteristic.

The estimated amount of water that could potentially be conserved in the planning area is 10.7 MGD for urban use within the 20-year planning horizon as a result of retrofit conservation measures. Achieving this savings is highly dependent on cooperating utilities. The District will continue to provide WaterSIP funding and increased technical assistance and outreach. Savings may vary from year to year as programs are implemented.

The District will actively engage in devising programs for retrofits. For example, the City of Stuart, expecting build-out during the planning horizon, may employ conservation along with reuse to continue use of the Surficial Aquifer System as their water source. The District has dedicated outreach specialists and intergovernmental representatives to assist utilities, local governments and water users to achieve the goals of this Plan.

**Table 18.** Recommended Measures for Conservation for Planning Region.

| Housing Stock Characteristic | Conservation Measure | Water Savings per Retrofit Device | Cost per Device | Cost per 1,000 gallons | Planning Area Savings Based on Retrofit of 75% of Characteristic Housing Stock |
|---|---|---|---|---|---|
| Housing Built Before 1984 | Showerhead retrofit | 3.5 gallons/minute | $20 | $.06/1,000 | 3.5 MGD |
| | Toilet retrofit | 4.4 gallons per flush | $200 | $.25/1,000 | 2.2 MGD |
| Pre-1992 Outdoor Irrigation Systems Without Rain Sensors | Rain sensor installation | 74 gallons/day | $68 | $.25/1,000 | 5.0 MGD |
| Planning Area Savings | | | | | 10.7 MGD |

**Table 19** provides a general list of recommended conservation measures that would be effective in different types of utility service areas based on the population growth rate, housing stock and potential for growth.

**Table 19.** Utility Characteristics and Conservation Methods.

| Type of Utility | Characteristics of Utilities | Utility Specific Recommendations |
|---|---|---|
| Large Growth Potential | Considerable existing housing stock of intermediate to old age, significant land available for new development | Indoor retrofits, Xeriscape™ ordinance, irrigation hours ordinance, outreach and education |
| Moderate Growth Potential | Existing housing stock intermediate in age, moderate potential for development – limited by boundaries of other utility service areas and natural areas | Indoor retrofits, Xeriscape™ ordinance, irrigation hours ordinance, promote Mobile Irrigation Lab, outreach and education |
| Limited Growth Potential | Housing stock is older, service area is near build-out, very limited potential for growth | Indoor retrofits, rain sensor installation, promote Mobile Irrigation Lab, outreach and education |

Outreach and education efforts in the planning area include annual conservation workshops held at the service center to showcase the District's funding programs for conservation and alternative water supplies, funding support for annual WaterFest events, support of Florida Yards and Neighborhoods and MIL educational efforts.

The District's WaterSIP is tailored to assist the community to partially fund projects, such as large-scale retrofits, as recommended by this Plan.

## Conservation – Implementation Strategies

The following are potential strategies for water conservation, which were developed in cooperation with the public that will be considered in developing plan recommendations regarding conservation.

- Landscape irrigation water conservation has the potential for significant water savings, and has the potential to reduce Surficial Aquifer System resource issues. This may be accomplished by expanding mobile irrigation lab activity in the planning area, and may involve local government funding partnerships to increase lab services, especially in newer urban communities.
- Local governments should consider developing ordinances to address water-conserving landscape installation for new construction to maximize water savings in initial design and operation of both residential and commercial sites.
- Implement cost-effective indoor and outdoor retrofits in the UEC Planning Area based on the preceding analyses.
- Complete water conservation rulemaking for Chapter 40E-2, F.A.C., and the *Basis of Review for Water Use Permit Applications*, emphasizing goal-based conservation programs for public water suppliers and major water users.
- Fund projects through the Water Savings Incentive Grant Program, including public/private partnerships, which further the preceding recommendations.
- Expand outreach and education through funding, public/private partnerships, the media, professional organizations and users.

## Floridan Aquifer System

The upper Floridan Aquifer is the principal source of supply to users of the Floridan Aquifer System (FAS) in the planning area. The top of the FAS lies approximately -300 feet National Geodetic Vertical Datum (NGVD) in the northwest corner of the planning area, then dips to the southeast to more than -900 feet NGVD in southeast Martin County. For most of the planning area, the Floridan Aquifer is artesian; the wells flow naturally at land surface without the need for a pump. Water in the FAS is brackish in the UEC Planning Area. Additional information on the hydrogeology of the FAS in the UEC Planning Area is provided in the *DRAFT Consolidated Water Supply Plan Support Document*.

The upper Floridan Aquifer is used extensively by citrus growers in the UEC Planning Area, primarily as a supplemental irrigation source when surface water availability is limited and as a primary source in areas where no surface water is available. Water from the Floridan is generally blended with surface water or water from the Surficial Aquifer to reduce potential problems associated with salinity. Excess salinity of irrigation water can result in decreased citrus production/yield, reduction in root growth, and can be fatal to specific root stocks (Syvertsen *et al.*, 1989). Construction of storage reservoirs associated with the CERP Indian River Lagoon – South Project will enhance surface water availability and should reduce the use of the Floridan Aquifer by the citrus industry.

Most coastal utilities in the region, including Fort Pierce Utilities Authority, Port St. Lucie, Martin County Utilities, South Martin Regional Utility, Plantation Utilities and Sailfish Point currently use water from the Floridan Aquifer as a source of drinking water. A number of smaller private coastal facilities use water from the Floridan Aquifer as a primary source for potable water. Water from the Floridan Aquifer is nonpotable throughout the planning area and requires desalination or blending prior to potable use. Utilities in the UEC Planning Area use reverse osmosis treatment to provide potable quality water. Water from the Floridan Aquifer accounted for 20 percent of total utility withdrawals in the UEC Planning Area in 2000 as shown in **Figure 8**. This is an increase from the 1998 usage, where Floridan Aquifer water accounted for 16 percent of the total utility withdrawal. Most of the utilities in the UEC Planning Area intend to use water from the Floridan Aquifer to meet increases in potable water demand.

The 1998 Plan analysis indicated the Floridan Aquifer has the potential of supplying sufficient water to meet all public water supply demands through the planning horizon, while meeting the supplemental water needs of agricultural users during a 1-in-10 year drought event without exceeding the resource protection criteria.

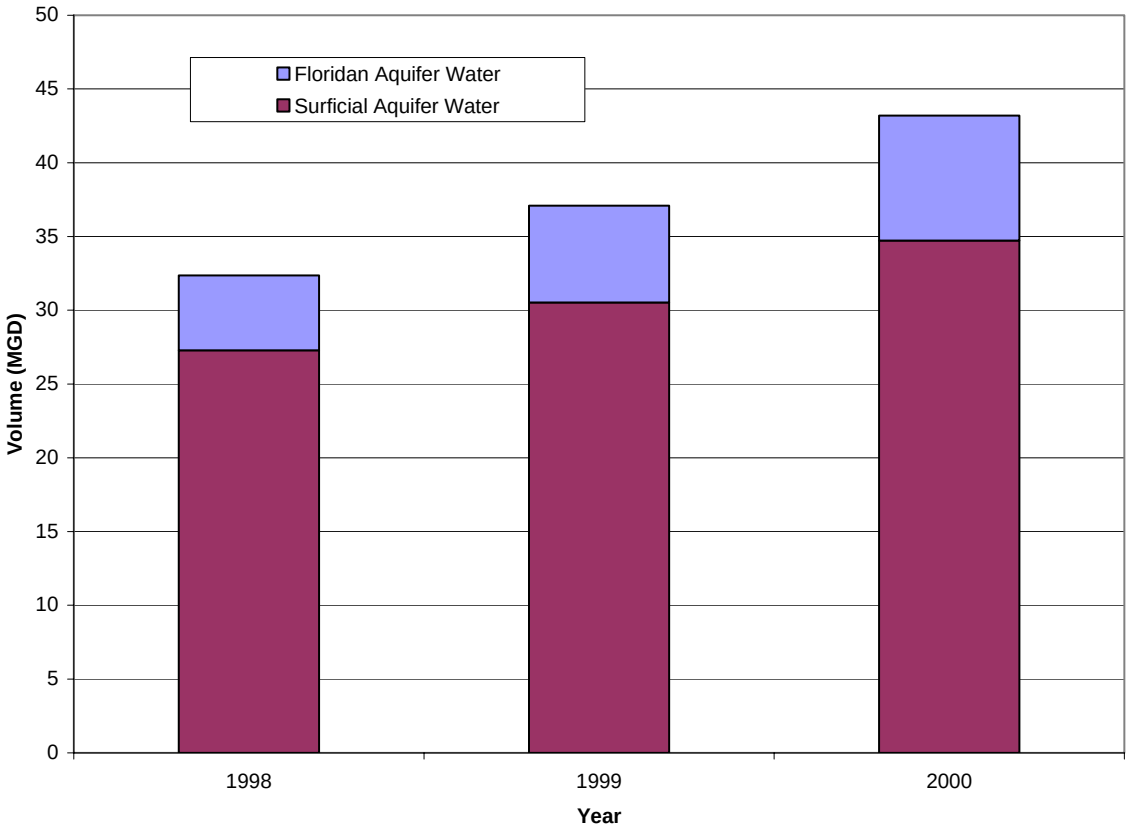



**Figure 8.** Public Water Utilities Potable Water Sources (1998–2000).

## Floridan Aquifer Monitoring Program

The relationship between water levels, water quality and water use needs to be better understood. A comprehensive Floridan Aquifer monitoring well network was established to monitor the effects of sustained withdrawals on the aquifer pursuant to the recommendations in the 1998 Plan. The purpose of the Floridan Aquifer monitoring network is to provide water level, water quality and water use data in high use areas (e.g., citrus groves) to determine statistical trends and relationships between the three data sets. Understanding these relationships will aid in the allocation of water from the Floridan Aquifer, and planning for long-term water supply in the region.

Monitoring began in 1999 at many of the locations in the monitoring well network. Four public water supply sites are being added to the network in 2004. A detailed summary of the network and data collected to date is provided in Appendix E. Additional data are needed to reach conclusions on the relationship between water levels, water quality and water use. Continued monitoring of this network is recommended. It is also recommended that public water supply wells be incorporated into the network.

The SFWMD also co-funded a study with the U.S. Geological Survey (USGS) to evaluate potential water quality changes and the distribution of salinity in the Floridan Aquifer. The final report from this study is scheduled for release in mid-2004. The aim of

the study was to identify potential sources of high salinity and potential flow mechanisms or pathways of groundwater to wells, and describe areas with a high potential for increases in salinity. The preliminary results found that water levels in the Floridan Aquifer in central and northern St. Lucie and Okeechobee counties have declined within recent years (2 to 4 feet in the past 15 years, 15 to 20 feet since predevelopment times). The head declines coincide with areas of agricultural use. These inland areas also have some structural deformations in the rock that could present exceptional pathways for groundwater flow. An area of elevated chloride concentration exists inland trending northwest through north-central Martin County and western St. Lucie County. The preliminary findings of the investigation indicate that the highest potential for upward or lateral movement of the saltwater interface is in the inland areas of St. Lucie and Okeechobee counties because of large declines in hydraulic head, areas of structural deformation and areas of higher salinity.

Development of a density-dependent solute transport groundwater model, including hydrogeologic investigations, is being proposed to conduct water quality predictive analysis for the next update to this Plan.

### Floridan Well Inventory

It is estimated that there are several thousand wells that penetrate the Floridan Aquifer in the UEC Planning Area. Most of these are for agricultural water supply and were drilled decades ago. There have been several initiatives over the past 15 years to inventory these wells; to provide assistance to well owners to install operable wellheads on free flowing wells, and to decommission wells that are no longer used or are in a state of disrepair. Some of these past inventories have been titled “Abandoned Floridan Well Inventory;” however, many of the wells in the inventories are permitted as active withdrawal sources through the District’s CUP Program. Under a consumptive use permit, withdrawal facilities must be maintained in good operating condition.

Because many of these wells were drilled decades ago, there is concern about their condition. Well casings, typically made of steel in older wells, could be corroded below the ground surface and wellheads could also be corroded. In addition, many of these wells are short-cased. The wells do not have a casing for the entire depth of the well into the Floridan Aquifer, such that the wells could be open to the Floridan Aquifer and also to the base of the Surficial Aquifer. Since the Floridan Aquifer is under greater hydrostatic pressure than the Surficial Aquifer, water could be flowing from the saline Floridan Aquifer to the fresh Surficial Aquifer through the well bores. There is also concern about the fate of these Floridan wells as agricultural use is converted to urban use. These wells should be properly decommissioned prior to conversion of the land to residential use.

The renewal of all individual and major general water use irrigation permits within the UEC Planning Area began in 2003. The renewal process in the UEC Planning Area is staggered by basin, with the last basin expiring on October 30, 2004. The renewal process consists of review and reissue of irrigation permits in accordance with current

District rules. Many of the irrigation permits in the UEC Planning Area were last issued in the 1980s. As part of the current renewal process, the District will update the existing Floridan well inventory. Wells that are no longer operational or active will have to be rehabilitated or properly decommissioned.

To ensure Floridan wells are identified and addressed in land formerly used for citrus production and planned for urban use development, there have been discussions of using the District's Environmental Resource Permitting (ERP) Program and/or CUP Program to notify developers of the presence of Floridan Aquifer wells. An environmental resource permit must be obtained before beginning any activity that could affect wetlands, alter surface water flows or contribute to water pollution, which includes urban development of most lands. If the proposed development is going to have associated self-supplied water use, a consumptive use permit will have to be obtained. As part of the processing of either of these two types of permits, the Floridan well inventory would be used to identify the existence of Floridan wells. Floridan wells not proposed for future use would have to be properly decommissioned. This process will also increase public awareness of Floridan wells.

### Decommissioning Assistance for Floridan Wells

There was considerable discussion at the public participation workshops of programs to assist landowners in decommissioning Floridan wells that are no longer in use. There were several programs that provided technical assistance and cost-share funds for decommissioning Floridan wells in the past. Decommissioning (sometimes referred to as well plugging or abandonment) generally consists of filling the entire well with grout. Past funding and technical assistance has been provided by the District, the USDA–NRCS Environmental Quality Incentive Program (EQIP) administered through the St. Lucie Soil and Water Conservation District. In the UEC Planning Area, over 400 wells have been decommissioned or rehabilitated by these programs over the past 15 years, including all known free-flowing wells.

In the future, these agencies should continue to provide technical assistance, which includes assisting new land owners in locating Floridan wells on their property through the District's well inventory, thereby increasing public awareness. One option discussed as a regional approach toward decommissioning Floridan wells was the possibility of the citrus industry pursuing a state appropriation for funding assistance.

### Effects of Floridan Aquifer Use on Surficial Aquifer

The 1998 Plan reviewed monitoring data and other related information regarding impacts of Floridan water use on the quality of the water in the Surficial Aquifer System. The data indicated the existence of elevated total dissolved solids concentrations in the Surficial Aquifer in western and central St. Lucie County. However, this was generally limited to areas in the aquifer less than 50 feet below land surface. There are some residential self-supply wells in these areas, but they are generally greater than 50 feet

deep. Based on this information, it was recommended that no further activity was needed. No additional data was reviewed for this Plan.

### Future Modeling and Analysis

Much of the Floridan Aquifer predictive modeling and analysis completed to date in the UEC Planning Area has focused on water levels in the aquifer. A comprehensive Floridan Aquifer monitoring well network has been established to collect information on water use, water levels and water quality. It is recommended that a density dependent (water quality) model be developed and used in the next five-year update to conduct predictive analysis on water quality in the Floridan Aquifer.

### Floridan Aquifer – Estimated Costs

The costs related to development of the FAS for water supply are provided in Chapter 3 of the *DRAFT Consolidated Water Supply Plan Support Document*. For potable water use, desalination treatment is required, such as reverse osmosis (RO). Drilling of a Floridan Aquifer well is a function diameter and depth. Cost for a 1,000-foot well depth is estimated to range from $150,000 for a 10-inch diameter cased well to $320,000 for a 24-inch diameter cased well. The water that can be withdrawn from an individual well is very site specific and varies within the UEC Planning Area. Current regulations for the region prohibit the withdrawal of water from a Floridan Aquifer well with a pump. Floridan Aquifer wells in the UEC Planning Area provide water by natural artesian flow. Production from Floridan Aquifer wells can be limited by several factors, including geology of the area, the rate of recharge and water movement in the aquifer, potentiometric head, well diameter and other existing legal users in the area. Typical production rates from Floridan Aquifer wells in the UEC Planning Area can range from 1 to 2 MGD.

For much of the UEC Planning Area, the Floridan Aquifer is artesian and flows at land surface without the need for pumps. In most agricultural uses of the Floridan, pumps are not used. For public water supply, pumps are needed to transfer water from the Floridan wells to the treatment facility. Pumping costs vary depending on the volume of water needed. For example, the construction cost for a 1-MGD pumping system is estimated to cost about $72,000 with an annual operation and maintenance cost of $28,000. Whereas, the construction cost for a 5-MGD pumping system is estimated to cost about $132,000 with an annual operation and maintenance cost of $104,000. Site-specific costs associated with RO can vary significantly as a result of source water quality; concentrate disposal requirements, land costs and use of existing water treatment plant infrastructure.

There are additional costs for water treatment for potable uses. As stated previously, since water from the Floridan Aquifer is brackish, desalination treatment is required prior to potable use. All utilities that use the Floridan Aquifer in the UEC Planning Area use RO for treatment and most use deep well injection for concentrate disposal. Treatment cost information is provided in Chapter 5 of the *DRAFT*

*Consolidated Water Supply Plan Support Document*. Estimated cost of reverse osmosis treatment with concentrate disposal via deep well injection including operation and maintenance is $2.15 per 1,000 gallons for a 3-MGD facility to about $1.84 per 1,000 gallons for a 10-MGD facility.

### Floridan Aquifer – Quantity of Water Potentially Available

The analysis in the 1998 Plan indicated that the Floridan Aquifer has the potential of supplying, at a minimum, a sufficient volume of water to meet at least 64 MGD of the public water supply demands (2020 public water supply projections in 1998 Plan), while meeting the supplemental water needs (125 MGD) of agricultural users during a 1-in-10 year drought event. The results of the modeling in the 1998 Plan indicate that there would be no resource protection criterion exceedances. To ensure that the resource is managed properly, the volume of water that could be withdrawn by any specific user must be determined through the District's CUP Program. The analysis did not address water quality degradation (increasing salinity) in the FAS because of increased, long-term withdrawals.

In the UEC Planning Area, the Floridan Aquifer has historically been used regularly by agricultural users, and to a lesser extent, by public water supply users. Out of the limited number of Floridan wells that have historic water quality records, some have showed increases in salinity. The 1998 Plan modeling did not include a water quality component as sufficient data did not and currently does not exist. However, the modeling indicated that water levels are not projected to decline below land surface over the planning horizon, and the experience in the UEC Planning Area suggests this should not result in significant changes in water quality. As stated previously, continued data gathering from the comprehensive Floridan Aquifer monitoring well network for water use, water quality and water levels is recommended. Data from this initiative could be used in modeling of water quality, as well as water levels, for the next update of this Plan.

### Floridan Aquifer – Implementation Strategies

The following are potential strategies developed in cooperation with the public that will be considered in the development of plan recommendations regarding the Floridan Aquifer:

- Continue to collect data from the comprehensive regional Floridan Aquifer monitoring well network to better understand the relationship between water quality, water levels and water usage.
- Develop a density dependent solute transport groundwater model for next UEC Plan Update for predictive analysis purposes.
- Implement a Floridan Aquifer exploratory well program to gather additional hydrogeologic data to support development of a Floridan Aquifer density dependent groundwater model.

- Conduct Floridan Aquifer tracer tests to better understand flow paths in the Floridan Aquifer.
- Refine the Floridan well inventory, increase public awareness of presence of Floridan wells when land is converted from agricultural use to urban use and support local initiatives to decommission wells that are no longer used.
- Provide technical support of local initiatives in pursuit of decommissioning Floridan Aquifer wells.

## Reclaimed Water

Reclaimed water is wastewater that has received at least secondary treatment and is reused after flowing out of a wastewater treatment plant (Chapter 62-610, F.A.C.). Water reuse is the deliberate application of reclaimed water for a beneficial purpose, in compliance with the FDEP and water management district rules. Potential uses of reclaimed water include landscape irrigation (e.g., medians, residential lots and golf courses), agricultural irrigation, groundwater recharge via percolation ponds, industrial uses, environmental enhancement and fire protection.

In addition to the more common use of reclaimed water, Chapter 62-610, F.A.C. also addresses the use of high-quality reclaimed water for groundwater recharge using injection wells and for indirect potable use.

The State of Florida encourages and promotes the use of reclaimed water. The Water Resource Implementation Rule (Chapter 62-40 F.A.C.) requires the FDEP and water management districts to advocate and direct the reuse of reclaimed water as an integral part of water management programs, rules and plans. The District requires all applicants for water use permits to use reclaimed water unless the applicant can demonstrate that it is not feasible to do so.

### 2003 Statewide Reuse Strategy Report

The *Water Reuse for Florida – Strategies for Effective Use of Reclaimed Water* report resulted from a joint venture between the Reuse Coordinating Committee and the Water Conservation Initiative's Water Reuse Work Group (Reuse Coordinating Committee, 2003). This report identifies strategies for increasing the efficiency and effectiveness of the use of reclaimed water in Florida, as directed by the *Florida Water Plan* (FDEP, 2002b) and as part of Phase II of the *Florida Water Conservation Initiative* (FDEP, 2002a). In addition to presenting background information on water reuse, a summary of Florida's Water Reuse Program, and development of water reuse in Florida, the report details 16 major, interrelated strategies for ensuring efficient and effective use of reclaimed water. Some of the strategies are:

- Encourage metering and volume-based rate structures
- Implement viable funding programs

- Facilitate seasonal reclaimed water storage
- Encourage use of reclaimed in lieu of other water sources
- Link reuse to regional water supply planning
- Encourage use of supplemental water supplies
- Encourage reuse system interconnects

The report provides a roadmap for the State's Water Reuse Program into the 21st Century. The *2003 Water Reuse for Florida* report (Reuse Coordinating Committee, 2003) is available from: http://www.floridadep.org/water/reuse/news.htm.

## Existing Reuse in UEC Planning Area

Reuse System Pumps

The use of reclaimed water in the UEC Planning Area has played a vital role in meeting a portion of current demands for irrigation water. The volume of reclaimed water that is used for a beneficial purpose has increased almost 70 percent from 1994 to 2003 as shown in **Figure 9**. Over this period, the volume of reclaimed water reused has varied from year to year depending on the addition of new users and rainfall.

In 2003, there were 28 wastewater treatment facilities in the UEC Planning Area with a capacity of 0.10 MGD or greater. The largest of these is the Fort Pierce Utilities Authority with a capacity of 10 MGD. Specific information on each facility and its location is provided in Appendix B. These facilities had a total capacity of over 34 MGD and treated over 20 MGD in 2003. There are three methods of treated wastewater management used in the UEC Planning Area: reuse, deep well injection and surface water discharge via ocean discharge.

Twenty-seven of the facilities used reuse for all or a portion of their disposal. About 40 percent (8.10 MGD) of the wastewater treated in the planning area in 2003 was reused for a beneficial purpose with over 5.43 MGD used for irrigation. In 2002, reclaimed water was used for irrigation of over 5,400 residential lots, 20 golf courses, three parks, five schools and a citrus grove (FDEP, 2003). About 2.20 MGD was used for groundwater recharge and the remainder was used for industrial and toilet flushing purposes. The results of the analysis indicates that current reuse in the UEC Planning Area, primarily irrigation of golf courses, has contributed to reduced potential resource impacts.

A few of the reuse systems in the planning area are limited at this time because the reclaimed water supply is fully committed or utilized during certain times of the year.

However, these utilities have surplus reclaimed water at other times of the year. To overcome shortfalls and maximize the use of reclaimed water, some utilities have developed supplemental supplies, such as storm water and groundwater. St. Lucie West supplements reclaimed water with water from its stormwater management lakes, while South Martin Regional Utility uses groundwater to supplement its reclaimed water.

Over 11 MGD of the 20 MGD wastewater treated in 2003 was disposed of by deep well injection. Five facilities have deep well injection systems, four in conjunction with some reuse. Ocean discharge accounts for a very small percentage of the total effluent disposal in the region. Only St. Lucie County uses ocean discharge for disposal (via the Florida Power & Light cooling outfall at its South Hutchinson Island Facility) when wastewater flows exceed reclaimed water demand. In 2003, all reclaimed water from this facility was reused and none was discharged to the ocean. The 11 MGD that was disposed of via deep well injection is potentially reusable water.

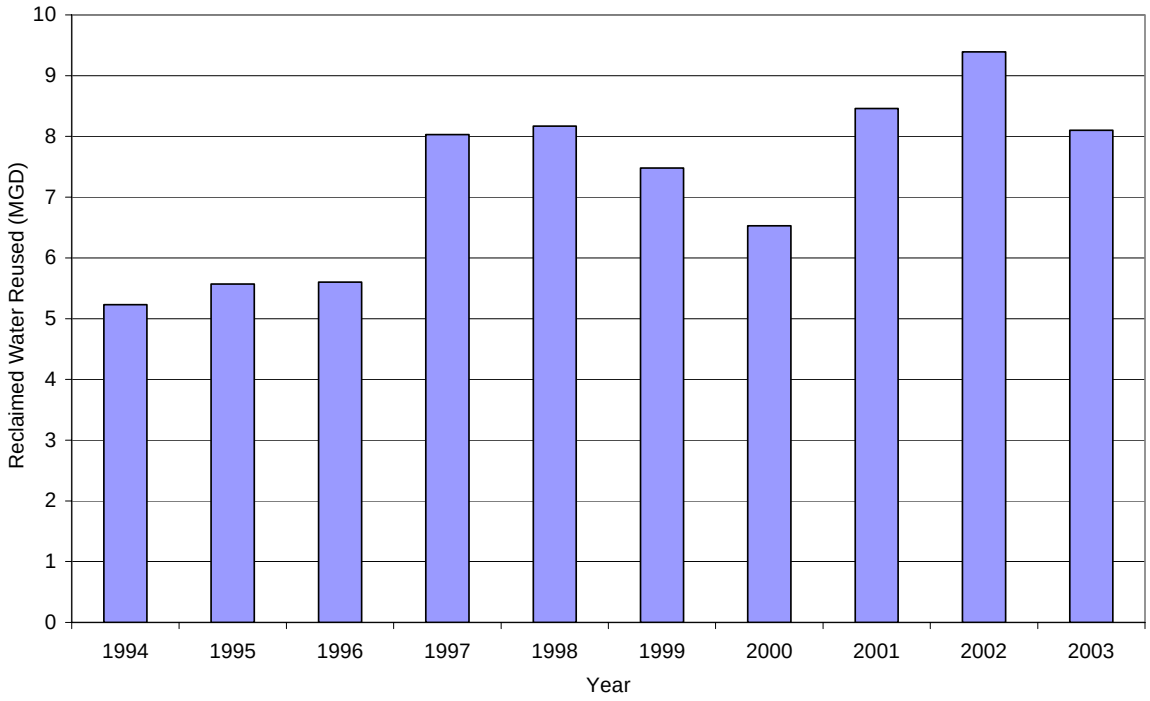



**Figure 9.** Reclaimed Water Use in the UEC Planning Area (1994–2003).

### Future Reuse in UEC Planning Area

Wastewater flows are projected to increase to about 40 MGD by 2025. Utilities involved in reuse at this time plan to continue reuse and expand their reuse systems as additional reclaimed water and users become available. Much of the future reuse will occur in new developments and reclaimed water will be produced from proposed facilities. Utility master plans have not been developed to date showing future plans through 2025. Due to insufficient data and rapid growth in the area, conceptualization of a future reuse layout and plan is not feasible at this time. There are several activities occurring that could lead to increased reuse in the future.

Port St. Lucie is consolidating and regionalizing its wastewater systems to two regional facilities within the next eight years: a new Glades facility and expansion of the Westport facility. The primary means of wastewater management at these regional facilities will be reuse via public access irrigation of residential lots and golf courses. The Northport and Southport wastewater facilities (majority of effluent disposal through deep well injection in 2003) will be decommissioned in the future.

The City of Stuart and the Fort Pierce Utilities Authority (FPUA) treat almost 35 percent of the wastewater generated in the planning area, and dispose of the effluent almost exclusively through deep well injection. The City of Stuart is initiating a feasibility study and master plan to identify opportunities for reuse, with a focus on replacing groundwater withdrawals for irrigation with reclaimed water in the vicinity of its wellfields. The FPUA wastewater facility is located on South Hutchinson Island and has limited reuse potential because of the lack of uses in the vicinity of the facility both on Hutchinson Island and the mainland. The FPUA is planning to use reclaimed water for irrigation of green space at a proposed development directly east of the facility. The FPUA, in cooperation with St. Lucie County, will identify mainland locations for a wastewater facility(s) to treat future wastewater flows beyond Fort Pierce's existing wastewater treatment facility capacity. Reuse will most likely be the primary means of wastewater management for such a facility. An alternative that may be considered in design of the new wastewater treatment facility is increasing the capacity of this new mainland facility to replace the existing capacity at the existing Fort Pierce wastewater treatment facility.

### Reclaimed Water Efficiency and Effectiveness

In addition to new facilities and expansion of existing reuse systems, implementation of water conservation measures, such as metering and volume-based rates, will promote more effective and efficient use of reclaimed water. Programs that provide reclaimed water at no charge to the user and the use of flat rates encourage overuse of the reclaimed water source. Studies conducted by the Southwest Florida Water Management District concluded that simply providing meters could reduce the use of reclaimed water by residential customers by 50 percent (SWFWMD, 2002). Metering of reclaimed water use and implementation of volume-based charges, in which users pay for at least part of the actual metered volume, are encouraged as a means to effectively manage reclaimed water supplies. Metering of reclaimed water use and implementation of volume-based rates for reclaimed water is a major strategy contained in the *Water Reuse for Florida – Strategies for Effective Use of Reclaimed Water* report to promote efficient use of reclaimed water (Reuse Coordinating Committee, 2003).

Proposed revisions to Florida's Water Resource Implementation Rule, Chapter 62-40, F.A.C., directs the FDEP and the water management districts to encourage reuse that is efficient and effective and will increase potable quality water offset or recharge fraction, where consistent with water quality protection. Potable quality water offset is the amount of potable quality water (Class F-I, G-I or G-II groundwater or water meeting drinking water standards) saved through the use of reclaimed water expressed as a

percentage of the total reclaimed water used. Dividing the amount of potable quality water saved by the amount of reclaimed water used, and multiplying the quotient by 100 calculates the potable quality water offset. The recharge fraction is the portion of reclaimed water used in a reuse system that recharges an underlying potable water quality groundwater (Class F-I, G-I or G-II groundwater) that is used for potable supply, or augments a Class I surface water, expressed as a percentage of the total reclaimed water used.

### Mandatory Reuse Zones

Reuse Facility

One tool to increase the use of reclaimed water is through the designation of mandatory reuse zones. Mandatory reuse zones are geographic areas designated by local governments through ordinance where the use of reclaimed water is required. These could be undeveloped areas or developed areas where retrofits will be required. These zones may be very effective in increasing reuse in the undeveloped portions of the service areas in the UEC Planning Area, where installation of the reclaimed water distribution systems and use of reclaimed water would be required at the time of development. It is much more cost-effective to install these systems at the time of development compared to retrofitting existing developments. Palm Beach County's mandatory reuse zone has successfully increased reuse at its Southern Region Wastewater Reclamation Facility.

### Reclaimed Water Storage

Because reclaimed water supplies in some reuse systems in the UEC Planning Area are fully committed during certain times of the year and have a surplus during other times of the year, seasonal reclaimed water storage through ASR may allow some systems to expand their user base. Simply stated, reclaimed water is stored when supply exceeds demand and stored water is withdrawn when demand exceeds supplies. Aquifer storage and recovery could also be used to store supplemental sources when sources are available for withdrawal in compliance with applicable rules and regulations.

### Supplemental Sources

Use of another water source, such as surface water, groundwater, storm water, or treated drinking water, to augment supplies of reclaimed water (largely to meet peak demands) can enable better utilization of the water resource. The use of supplemental water supplies to meet peak demands for reclaimed water may enable a reclaimed water utility to be more aggressive in implementing its reclaimed water system. More customers can be served with reclaimed water and less "excess" reclaimed water would

need to be disposed of. Use of supplemental water supplies is normally subject to consumptive use permitting by the water management districts. In some areas, these sources of water may not be available as a supplemental source in times of drought.

St. Lucie West currently supplements its reclaimed water with water from its stormwater management lakes. South Martin Regional Utility uses groundwater to supplement its reclaimed water.

### Reuse System Interconnects

Reuse system interconnects refers to enhancing the connection between reclaimed water systems to facilitate reuse. More specifically, reuse interconnects are connections between two or more reclaimed water distribution systems (may be owned or operated by different utilities) or between two or more domestic wastewater treatment facilities that provide reclaimed water for reuse activities.

Reuse system interconnects offer a means to increase both the efficiency and reliability of reuse systems. When two or more reuse systems are interconnected, there is additional flexibility present in meeting the demand of the reuse system customers, as well as an increase in the reliability of providing acceptable reclaimed water for reuse. For example:

- One system may be newer with fewer customers and be adjacent to a more mature system that could utilize additional reclaimed water to meet the needs of its customers.
- An interconnect between a mature reuse system and a system that has no reuse or limited reuse customers can help avoid or limit the need for a supplemental ground or surface water supply to meet seasonal demands in the more mature system.
- If one reclaimed water facility experiences a temporary problem with producing reclaimed water of acceptable quality, the interconnect with another facility can provide a means to enable continued delivery of reclaimed water to system customers, while the problem is resolved.
- Interconnects may offer the ability to share system storage facilities, which would increase flexibility, while maximizing use of existing storage facilities. As ASR becomes more common as a means for storing reclaimed water, reuse system interconnects could provide opportunities for development of shared ASR systems as key components of regional reuse programs.

### Regional Reclaimed Water Conveyance System Master Plan for Northern Palm Beach County and Southern Martin County

The District conducted the *Regional Reclaimed Water Conveyance System Master Plan for Northern Palm Beach County and Southern Martin County* in 2002 to evaluate the potential of transporting reclaimed water from the East Central Regional Wastewater Treatment Facility in West Palm Beach north to northern Palm Beach County and southern Martin County to meet current and unmet future needs (SFWMD, 2002g). Potential uses of reclaimed water included irrigation of golf courses, residential lots and other green space, industrial cooling and groundwater recharge. The study included the service areas of Seacoast Utility and the Loxahatchee River Environmental Control District in Palm Beach County and South Martin Regional and Martin County Utilities.

Several demand scenarios and pipeline routes were evaluated. Based on this evaluation, it was determined that a regional reclaimed water system is not economically feasible based on meeting unmet demands of new developments. New reclaimed water demand in northern Palm Beach County and southern Martin County within the planning period, based on local comprehensive plans and development proposals, is very limited. Most of the developable land within northern Palm Beach County has existing water use permits or includes proposed development with commitments from existing reclaimed water providers. A large portion of southern Martin County is preserved as a state park or other environmentally protected areas. In addition, a significant portion of the land is designated as agricultural or low density residential. Without changes to the future land use designations, no significant demand is projected. If a large industrial water user locates within the study area, there may be sufficient demand to lower the unit cost to a feasible level.

### Martin County Consolidated Reuse System

Martin County Utilities currently operates four regional wastewater facilities within the county. Each of these facilities provides reclaimed water for public access irrigation. The county is in the process of interconnecting the Martin Downs, Port Salerno and Tropical Farms reuse systems associated with these facilities into a consolidated reuse system. Martin County is also in the process of centralizing wastewater treatment to two facilities—North and Tropical Farms. By interconnecting their reuse systems, the county will be able to maximize the use of reclaimed water by having the ability to distribute reclaimed water throughout their service area, moving reclaimed water from areas of surplus to areas where currently the potential demand is greater than the supply.

## Reclaimed Water – Estimated Costs

The costs associated with use of reclaimed water can be divided into treatment costs and transmission/distribution costs. The ultimate use of the reclaimed water directly affects the treatment, distribution and costs. For the purposes of this section, the cost associated with developing a public access reuse system will be summarized. Public

access irrigation involves using reclaimed water for landscape irrigation, such as medians, residential lots, golf courses and other green space.

All the facilities in the UEC Planning Area provide secondary treatment, and several equipped with treatment components to produce reclaimed water for public access irrigation. For those facilities that have secondary treatment only, treatment would have to be upgraded to advanced secondary treatment. Advanced secondary treatment typically refers to the addition of filtration and high-level disinfection. Estimated costs for construction and operation and maintenance of advanced secondary equipment range from $0.53 per 1,000 gallons for a 1-MGD facility to about $0.24 per 1,000 gallons for a 10-MGD facility.

The cost of transmission and distribution of reclaimed water can be substantial, and varies significantly from rural settings to highly urbanized settings. Systems may consist of a single pipe conveying reclaimed water to a golf storage pond to very complex distribution systems that convey reclaimed water to individual residential lots. The length and diameter of pipe, land requirements, land costs, utilities existing in the right-of-way and terrains (sidewalks, driveways, roads, etc.) all affect the cost of transporting and distributing reclaimed water. From projects in Florida, the transmission/distribution cost have ranged from a low of around $0.40 per 1,000 gallons for some large multi-customer reuse systems, which are in close proximity to a treatment facility, to over $3.00 per 1,000 gallons for retrofit residential areas.

The use of reclaimed water also results in some cost avoidance, such as reducing the use of alternative disposal systems and eliminating the need for another water supply source by the end user. In addition, reclaimed water contains nutrients, which reduce the amount of fertilizers needed when irrigating with reclaimed water.

### Reclaimed Water – Quantity of Water Potentially Available

Most of the utilities in the region have not projected wastewater flows through 2025. To estimate wastewater flows for 2025, the 2003 ratio of wastewater treated to water pumped for public water supply was applied to the 2025 public water supply projected water supply needs. In 2003, the ratio of wastewater treated (20 MGD) to water pumped for public water supply (39 MGD) was about 51 percent. The projected public water supply demand for 2025 is about 78 MGD (Appendix A). By applying the 51 percent ratio to the projected 2025 public water supply water demand for the UEC Planning Area, it is estimated wastewater flows will increase to about 40 MGD by 2025. This is all potentially reusable water. Based on utility plans and the availability of other water resources, it is anticipated that reuse of 75 percent of the wastewater treated could be achieved by 2025.

### Reclaimed Water – Implementation Strategies

The following are potential strategies developed in cooperation with the public that will be considered in the development of plan recommendations regarding reclaimed water:

- Encourage reclaimed water interconnects between utilities, where appropriate, to maximize use of reclaimed water.
- Provide additional weight to criteria that recognize efficient use of the resource, rewarding the District's Water Savings Incentive Program (WaterSIP) and the Alternative Water Supply (AWS) Funding Program applicants with increased scores, which could lead to more grant awards. Projects could include metering, volume-based rates, and/or establishment of application rates consistent with the District's CUP Program allocation criteria as part of the grant project.
- Provide technical assistance to local governments in establishing mandatory reuse zones (where appropriate) to increase use of reclaimed water.
- Provide technical support to utilities pursuing reclaimed water ASR.
- Develop AWS funding criteria for reuse projects that use reclaimed water efficiently, or are requirements of consumptive use permits.

## Reservoirs

This option involves the capture and storage of excess surface water in reservoirs during rainy periods and the subsequent release during drier periods for environmental and human uses. Regionally, surface water storage is anticipated to attenuate freshwater flows to the St. Lucie River and Estuary, the Indian River Lagoon and the Northwest Fork of the Loxahatchee River and Estuary during rainy periods, and to provide beneficial flows during drier times. In addition, these facilities could increase surface water availability for current and projected agricultural uses, and decrease the demand on aquifer systems, particularly the FAS.

Strategically located surface water storage (primarily storage in combination with improved stormwater management systems) could recharge Surficial Aquifer System (SAS) wellfields, reduce the potential for saltwater intrusion and reduce drawdowns under wetlands. Onsite storage in agricultural areas may reduce the need for water from the regional canal system and withdrawals from other water source options. Stormwater reservoirs could be located with ASR facilities, and provide a water source for the facility.

### Reservoirs – Estimated Costs

Costs associated with reservoirs can vary significantly depending on site-specific conditions of each reservoir, land costs and facilities, such as pumps. A site located near an existing waterway will increase the flexibility of design and management and reduce costs associated with water transmission infrastructure. Another factor related to cost would be the existing elevation of the site. Lower site elevations would allow for maximum storage for the facility, while reducing costs associated with water transmission and construction excavation. Depth of the reservoir will have a large impact on the costs associated with construction. Deeper reservoirs result in higher levee elevations that can significantly increase construction costs. Costs associated with reservoirs are provided in Chapter 3 of the *DRAFT Consolidated Water Supply Plan Support Document*.

### Reservoirs – Quantity of Water Potentially Available

Reservoirs are considered a management option, in that these systems allow more efficient use of other sources, such as surface water. The CERP Indian River Lagoon – South Project Implementation Report (PIR) estimates the project could increase surface water availability by 26,300 acre-feet per year (23.48 MGD). District staff estimate this could result in a decrease of 19 percent in Floridan Aquifer usage for agriculture, further assuring the water needs of the agricultural community.

### Reservoirs – Implementation Strategies

Regional reservoirs proposed in the UEC Planning Area are through the CERP Indian River Lagoon – South Project, Ten Mile Creek Critical Restoration Project, CERP North Palm Beach County Part 1 Project and the Northern Palm Beach County Comprehensive Water Management Plan. Recommendations related to these projects are incorporated in the Surface Water section of this chapter. One potential strategy developed in cooperation with the public that will be considered in the development of plan recommendations regarding reservoirs is:

- Agricultural operations should incorporate best management practices to include water conservation and water supply considerations in design of new or retrofitted surface water management systems.

## Seawater

This option involves using seawater from the Atlantic Ocean as a raw water source. The ocean (seawater) is an unlimited source of water from a quantitative perspective; however, removal of salts (desalination) is required before potable or irrigation uses are feasible. To accomplish this, a desalination treatment technology would have to be used, such as distillation, reverse osmosis (RO) or electrodialysis reversal (EDR).

### Seawater – Estimated Costs

Reverse Osmosis Facility

The cost of seawater desalination can be significant, several times the cost of brackish groundwater desalination. This is due to seawater's higher and variable salt content, intake facilities and concentrate disposal. The higher and variable salt content reduces the efficiency of the treatment facility (less gallons of potable water are produced from raw water pumped) and results in increased concentrate/reject water disposal needs compared to desalination of the brackish groundwater. Cost information on seawater desalination facilities from countries outside of the United States indicates costs can be significant for seawater desalination. For example, in Singapore, a 36-MGD seawater desalination plant was estimated to cost between $7.52 and $8.77 per 1,000 gallons in the early to mid-1990s. In the United States, the cost of seawater desalination has decreased from about $9 per 1,000 gallons for a stand-alone facility to about $3 per 1,000 gallons for a colocated facility between 1990 and 2000 (SFWMD, 2002b).

One way to reduce the cost of seawater desalination is to colocate the desalination facility with a power generating facility that uses seawater for cooling. There are many benefits of colocating desalination facilities and electric power plants. One benefit and cost reduction is the sharing of facility components. There is cost savings associated with using the existing intake and discharge structures of a power plant to provide raw water to the desalination plant and to provide a means for concentrate disposal. It is possible to dispose of the desalination process concentrate by blending it with the power plant's cooling water discharge. Using power plant cooling water as a source, the temperature of the water is elevated, which reduces the pressure and associated energy necessary to produce the drinking water, providing another significant advantage.

Seawater desalination has proven to be economically feasible in some parts of Florida when colocated with power plants. Tampa Bay Water recently completed construction of a seawater desalination RO treatment facility initially capable of producing 25 MGD of drinking water. The wholesale cost for the desalinated water over the next thirty years is projected to average $2.49 per 1,000 gallons. The 25-MGD facility cost $110 million and began producing water in March 2003 (Tampa Bay Water, 2003). However, water production has been interrupted due to excessive fouling (plugging) of the RO membranes. Negotiations are continuing to rectify the problems and resolve potential contractual issues.

The SFWMD cost-shared a feasibility study with Florida Power & Light (FPL) to investigate the potential of developing colocated RO water treatment facilities with electrical power plants pursuant to a recommendation of the *2000 Lower East Coast*

*Regional Water Supply Plan*. The study's findings recommended FPL's Fort Myers and Port Everglades sites as technically and economically feasible for colocated seawater desalination facilities.

### Seawater – Quantity of Water Potentially Available

The volume of water available from seawater is unlimited and could meet the needs of this region through the year 2025.

### Seawater – Implementation Strategies

As part of the 2004 UEC water supply planning process, it was concluded that seawater is a potential alternative source of water that needs future consideration; however, not in the 2025 planning horizon. Based on the projected water demands, other water sources are available to meet projected needs that have lower treatment costs.

## Surface Water

This option involves surface water and surface water-related environmental supply strategies to ensure the needs of the environment are met. Strategies include MFLs, water reservations, restoration plans, environmental restoration and CERP projects. Surface water includes the direct withdrawal of water from regional surface water sources, primarily the C-23, C-24, C-25 and C-44 canals. Related efforts involve the capture and storage of excess surface water during rainy periods and subsequent release during drier periods for environmental and human uses. Regionally, this includes reservoirs for storage of surface water that could be used to attenuate freshwater flows to the St. Lucie River and Estuary, the Indian River Lagoon (IRL) and the Loxahatchee River during rainy periods and meet minimum flows during drier periods. In addition, these facilities could increase surface water availability for other uses. In Martin and St. Lucie counties, increased surface water availability could reduce the use of the Floridan Aquifer for agricultural irrigation. This option also includes increasing flexibility in surface water management by connecting surface water basins.

### St. Lucie River and Indian River Lagoon

Freshwater discharges from the C-23, C-24, C-25 and C-44 canals, and local runoff to the St. Lucie River and Estuary and the Indian River Lagoon have sometimes negatively impacted the estuarine system. Moreover, periodic, high-volume, prolonged freshwater releases from Lake Okeechobee via the C-44 Canal have also had a dramatic effect on water quality and salinity and the overall health of the estuarine system. A MFL was established for the St. Lucie River and Estuary in 2002. To address the problems caused by excessive flows, the CERP Indian River Lagoon – South PIR has been completed and the USACE and the District are pursuing the incorporation of this Project into the *Water Resource Development Act of 2004* (WRDA 2004). Construction of the CERP Indian River Lagoon – South and the Ten Mile Creek Critical Restoration projects

will address freshwater flows from the watershed; the CERP in concert with possible modifications to the Lake Okeechobee Regulation Schedule, will address freshwater discharges from Lake Okeechobee to the St. Lucie River via the C-44 Canal.

### Minimum Flows and Levels

As stated previously, a MFL was established for the St. Lucie River and Estuary in 2002. The District realizes that a MFL alone will not be sufficient to maintain a sustainable resource during the broad range of water conditions occurring in the managed system. Setting a minimum flow is a starting point to define the minimum water needs to protect water resources against significant harm.

Research and monitoring for the St. Lucie River and Estuary MFL is being conducted through ongoing and proposed activities associated with the Indian River Lagoon Surface Water Improvement and Management (SWIM) Plan and the CERP Indian River Lagoon – South Project to provide for enhanced freshwater deliveries and track conditions in the system. These programs include periodic water quality sampling and the installation and monitoring of permanent flow and salinity stations at various locations in the estuary and its major tributaries.

### CERP Indian River Lagoon – South Project

The purpose of the CERP Indian River Lagoon – South Feasibility Study was to evaluate methods to improve surface water management in the C-23, C-24, C-25 and C-44 basins by providing increased storage and reducing the need for periodic high-volume discharges. The actions would improve habitats in the St. Lucie River Estuary and the Indian River Lagoon and increase surface water availability. The CERP *Final Indian River Lagoon – South Project Implementation Report Public Notic*e was signed by the USACE in Atlanta in March 2004. The PIR will be submitted to the USACE Headquarters in Washington, D.C. for final review. Approvals are being sought to incorporate the CERP Indian River Lagoon – South Project in the WRDA 2004. Construction could start as early as 2006 and is scheduled to take six years to complete at an estimated cost of $1.21 billion.

The recommended plan in the CERP Indian River Lagoon – South PIR provides over 135,000 acre-feet of storage via four reservoirs covering 12,610 acres. The reservoirs, with their associated stormwater treatment areas, are expected to increase surface water availability, which should reduce agricultural demand on the Floridan Aquifer in the area.

In addition, four stormwater treatment areas are proposed to reduce phosphorus and nitrogen. These treatment areas encompass 8,731 acres, and will provide 35,000 acre-feet of storage. Additionally, 92,130 acres of natural storage and treatment areas will provide over 30,000 acre-feet of storage. The project is expected to increase water availability by 26,300 acre-feet per year (23.48 MGD), which will result in a decrease in Floridan Aquifer usage for agriculture.

The recommended plan also incorporates the removal of 5,500 cubic yards of muck and the creation of 90 acres of artificial habitat. Integrated as a component of the plan, the restoration of the North Fork floodplain includes reconnection of historic oxbows and acquisition of over 3,000 acres of floodplain. A map of the recommended plan is located in Appendix E.

## Reservations

The Project Implementation Report (PIR) for the CERP Indian River Lagoon – South Project presently indicates the District will adopt initial reservations of existing water for the protection of fish and wildlife for the St. Lucie River and Southern Indian River Lagoon. The process for adopting these reservations is expected to begin in the summer of 2004 and is anticipated to occur over an approximate two-year period.

Additionally, and prior to execution of the Project Cooperation Agreement (PCA), the District will reserve water made available by the CERP Indian River Lagoon – South Project for protection of fish and wildlife. Presently, staff expects execution of the PCA to occur in approximately 2006.

## Ten Mile Creek Critical Restoration Project

After many years of planning and design, construction of the Ten Mile Creek Critical Restoration Project was initiated in November 2003. The project involves construction of a 550-acre reservoir (maximum depth of 10 feet) and a 110-acre stormwater treatment area (maximum depth of 4 feet). This project is located immediately west of the Varn (a.k.a. Gordy Road) Structure on Ten Mile Creek in St. Lucie County and will provide storage and treatment of storm water from the Ten Mile Creek Basin, the largest subbasin discharging into the North Fork of the St. Lucie River. In addition, the Ten Mile Creek Critical Restoration Project will increase surface water availability to agricultural users in the basin. The construction is scheduled to take less than two years to complete and will cost approximately $26 million.

Ten Mile Creek

## Basin Interconnects

For many years, there has been discussion of connecting the SFWMD's C-25 Basin with the St. Johns River Water Management District's C-52 and Upper St. Johns River Basin Project. This connection could potentially provide flexibility and efficiency in water management that would allow storage of water that is being discharged to tide.

This potential alternative would store water during wet periods and provide water for environmental needs and water supply during dry periods. Participants at the UEC Plan Water Resource Advisory Commission (WRAC) workshops supported further evaluation of this alternative by the two water management districts to determine its potential in addressing freshwater flows to the Indian River Lagoon and water supply needs of the region.

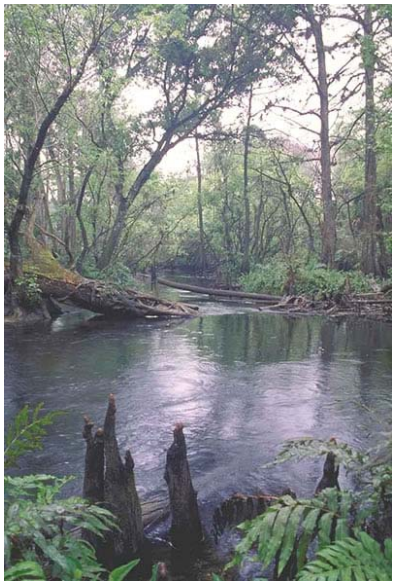
### Lake Okeechobee Regulation Releases

The CERP Indian River Lagoon – South Project is addressing surface water management and freshwater flows generated within the planning area to the St. Lucie River. In addition to receiving fresh water from the watershed, the St. Lucie River also serves as a major outlet for Lake Okeechobee. The C-44 Canal conveys flood control releases from Lake Okeechobee to the South Fork of the St. Lucie River. Regulatory discharges are usually large volume releases for prolonged periods of time and drastically change the water quality in the St. Lucie River.

The Lake Okeechobee Regulation Schedule is reviewed periodically to determine if operational changes can be made that have more ecological benefits, while meeting the Central and Southern Florida (C&SF) Flood Control Project objectives. This includes evaluating discharges made to the St. Lucie Canal (C-44). Structural changes are necessary to substantially affect these discharges to the St. Lucie River. These structural changes are incorporated into the CERP. Participants in the UEC Plan public workshops agreed that the best approach to this issue is the implementation of the CERP to address regulatory releases from Lake Okeechobee to the St. Lucie River.

### Loxahatchee River

The Loxahatchee River has been significantly impacted by the creation and maintenance of the Jupiter Inlet, which has contributed to the displacement of freshwater wetland communities by estuarine species in areas of the Loxahatchee River where they were not historically found. In addition, construction of the C-18 Canal and installation of drainage projects for agricultural and urban development have lowered water tables and reduced the amount of fresh water available to the Loxahatchee River and significantly altering natural flow patterns.



**Loxahatchee River**

Progress is being made by the District, USACE and local governments in improving flows to the Northwest Fork of the Loxahatchee River. This process includes structural improvements in addition to policy/regulatory improvements. The Northern Palm Beach County Comprehensive Water Management Plan (NPBCCWMP) was accepted in

2002 by the SFWMD and a MFL has been established in 2002 for the Northwest Fork of the Loxahatchee River. Recommendations of the *2000 Lower East Coast Regional Water Supply Plan* related to the Loxahatchee River are also being implemented.

The District and the FDEP are currently developing a Loxahatchee River restoration goal and plan. This work is expected to be complete in September 2005. Based on this plan, the agencies currently envision a multi-step process. First, the District is expected to adopt an initial water reservation for the Northwest Fork of the Loxahatchee River. Subsequently, a project specific water reservation, reserving a portion of the water in the L-8 Reservoir for the Northwest Fork is to be established. Finally, a CERP reservation for the Northwest Fork will address and reserve the amount of water necessary for restoration within the Northwest Fork of the Loxahatchee River and other environmentally sensitive areas within the watershed, such as the Loxahatchee Slough. Minimum flows and levels will be established for the tributaries to the Northwest Fork (Cypress Creek, Hobe Grove Ditch, Kitching Creek and Loxahatchee Slough) by 2007.

### Northern Palm Beach County Comprehensive Water Management Plan

The Northern Palm Beach County Comprehensive Water Management Plan (NPBCCWMP) was accepted by the SFWMD's Governing Board in May 2002 and is being implemented. The purpose of this effort was to develop a collective vision that would meet present and future urban, agricultural and environmental water resource needs for the northern Palm Beach County area. Implementation of the NPBCCWMP will bring about improvements to storage and water conveyance infrastructure that will capture water currently lost to tide in the wet season and provide supplemental supplies in the dry season—meeting environmental needs and projected urban and agricultural demands. The NPBCCWMP identifies needs for the following infrastructure improvements:

- 48,000 acre-feet of storage in regional reservoirs.
- 50 MGD of water storage in regional ASR facilities.
- 12,000 acre-feet of additional storage in wetlands and local reservoirs.
- 10 MGD obtained from reclaimed water.

Additional structural features are needed to improve the ability to convey surface water among storage areas, control water levels in the Loxahatchee Slough and provide flow to the Northwest Fork of the Loxahatchee River. The District's efforts include:

- Construction of the G-160 Loxahatchee Slough Structure in northeastern Palm Beach County was completed in January 2004. This $2.1 million spillway structure provides essential freshwater flows to the Northwest Fork of the Loxahatchee River during the dry season and also maintains a more natural hydroperiod within the slough.

- Groundbreaking for the G-161 Northlake Boulevard Structure took place in early 2004. The proposed $1 million culvert structure would create a flowway from the Grassy Waters Preserve to the Loxahatchee Slough (C-18 Basin). The structure will pass approximately 150 cubic feet per second (cfs) under Northlake Boulevard in Palm Beach Gardens.
- Purchase of approximately 44,800 acre-feet of storage at the L-8 Reservoir in the L-8 Basin. The reservoir is located immediately west of the L-8 Borrow Canal and north of the C-51 Canal in Palm Beach County.

The Northern Palm Beach County Comprehensive Water Management Plan is available from: http://www.sfwmd.gov/org/wsd/npbcwmp/npbcwmp-doc.htm.

## Minimum Flow and Level

An initial MFL was established for the Northwest Fork of the Loxahatchee River in 2002 and is codified in Chapter 40E-8, F.A.C. A summary of the MFL for the Northwest Fork of the Loxahatchee River is described in **Chapter 3**. The MFL was adopted to protect the Northwest Fork from significant harm.

After completing the restoration plan and initial water reservations for the Loxahatchee River, the MFL and associated recovery plan for the Northwest Fork will be reviewed and revised, as necessary, for consistency. The MFL Rule was designed with the flexibility to further ensure no significant harm by aligning it with restoration efforts as further information and data become available. Establishment of MFLs for the tributaries (Cypress Creek, Hobe Grove Ditch, Kitching Creek and Loxahatchee Slough) to the Loxahatchee River is scheduled for 2007.

## Water Reservations

The MFL Rule for the Northwest Fork of the Loxahatchee River states that the SFWMD intends to adopt an initial reservation by 2004 to protect existing water used for protection of fish and wildlife, consistent with the restoration goal identified for the Loxahatchee River. This water reservation will be reviewed periodically and revised in light of changed conditions, such as the changes that will occur in the C&SF Flood Control Project as CERP projects become operational. This provides flexibility to account for changes in implementation strategies and contingency plans during the life of the project.

When developing reservations, all current existing legal uses of water will be protected as long as the use is not contrary to public interest. Adoption of water reservations will be consistent with state law. To protect water made available for the recovery and restoration of the Loxahatchee River through implementation of some of the projects identified previously, the SFWMD intends to adopt water reservations for the

Northwest Fork of the Loxahatchee River on a project-by-project basis over the next 20 years.

Future reservations related to the Northwest Fork will be consistent with the reservations being developed for restoration of the Everglades under the CERP, and will reflect the needs of the natural system through a range of hydrologic conditions. These water reservations are intended to prevent the fresh water needed for restoration of the Northwest Fork of the Loxahatchee River from being allocated for future consumptive use. The reservations will be implemented through the CUP Program, operational protocols, water shortage rules and other appropriate provisions in Chapter 373, F.S.

### CERP North Palm Beach County Part 1

This project builds on the findings of the NPBCCWMP. The CERP North Palm Beach County Part 1 is addressing the interdependencies and tradeoffs between the different elements in the NPBCCWMP to provide a more efficient and effective design for the overall project. Project information can be obtained at http://www.evergladesplan.org/.

These CERP projects will provide water for environmental enhancement of the Loxahatchee River, Loxahatchee Slough and Grassy Waters Preserve. The PIR is currently under development. The projects will:

- Improve hydrologic connections between protected natural areas.
- Improve Lake Worth Lagoon.
- Reduce dependence on Lake Okeechobee during periods of drought.
- Reduce water lost to tide.
- Improve natural areas within the project boundary.
- Increase water management options.
- Improve the quality, quantity, timing and distribution of water delivery to the Loxahatchee River and Estuary, including the Northwest Fork.

### Current Martin County Loxahatchee Basin Activities

Martin County's Office of Water Quality was created to ensure the county's goals and objectives for protecting, restoring and enhancing the county's rivers and overall water resources are achieved. The Office of Water Quality is responsible for development, design and implementation of capital stormwater projects that improve and enhance local waters. This office works closely with the SFWMD, FDEP, USACE, as well as related state and federal agencies in developing and implementing the CERP and other related water quality and resource projects that affect Martin County.

The following are project summaries for efforts made by Martin County to enhance water quality and expand wildlife habitat.

**Tropic Vista and Little Club.** Tropic Vista and Little Club are two stormwater projects that will enhance and improve water quality, timing and volume of delivery of storm water to the Loxahatchee River. In addition to these benefits, both projects will improve stormwater management to address local flooding problems. Martin County has been working with local landowners and Jonathan Dickinson State Park to complete these projects.

**Pal-Mar/Cypress Creek/Hobe Grove.** As part of its efforts to assist in restoring the Loxahatchee River, Martin County teamed with the SFWMD, Florida Fish and Wildlife Conservation Commission (FWC) and FDEP, to initiate a study to address water resource related issues in the Loxahatchee Basin. The first phase of the study, funded by the SFWMD with support from its partners, will complete detailed basin modeling. The next phase of work is scheduled to begin in mid to late-2004, with funding from Martin County, the SFWMD and private sources, for further investigation of engineering and design alternatives to address these basin issues. The model will provide a basis for optimal management of wetlands on the Pal-Mar property, possible diversion of flow from the C-44 Canal through irrigation infrastructure to supplement flow to the Northwest Fork, identification and management of discharges from the citrus groves and Cypress Creek to the Northwest Fork, and improved flood control for local residences.

**Cypress Creek.** Palm Beach and Martin counties and the SFWMD acquired approximately 4,000 acres of the Cypress Creek/Loxahatchee Tract in January 2003. The Martin County lands are under an interim management arrangement with the SFWMD, and more permanent plans for this acreage will be taking shape in the near future. Martin County is requesting state and federal funding for support of design, engineering and construction of facilities that will contribute to the restoration of the Loxahatchee River. That request will be submitted within the Loxahatchee River Preservation Initiative for 2004.

**Pal-Mar East.** The Pal-Mar East Project is comprised of approximately 3,000 acres of historic wetlands that have been converted largely to rangeland. This parcel is essential to the restoration of the Loxahatchee River, and is the final link in establishing the greenway and trail from the Atlantic Ocean to Lake Okeechobee. Martin County is partnering with the SFWMD in order to purchase this land.

**Kitching Creek Restoration.** This basin's restoration project will include headwater revitalization, rehydration of disturbed wetlands, redistribution of fresh water and restoration of historic wetlands bisected by the construction of Bridge Road (CR 708) and Flora Avenue. Benefits of this project component are improvements in the water quality and quantities flowing into Jonathan Dickinson State Park property to the southeast, as well as an increased flood protection level of service for local residences and businesses. Martin County is also working with the USACE to complete a restoration project for the main area of the Kitching Creek Basin. Currently, flows through the Kitching Creek Road Ditch cause

erosion, flooding and excessive nutrient impacts to Jonathan Dickinson State Park. Redirection of these flows will be accomplished by the re-grading of drainage ditches, providing shallow flowways through existing rights-of-way and county properties and easements. Ultimately, storm water will be conveyed to Kitching Creek's predevelopment flowway and proposed construction of a berm east of Powerline Avenue will direct flow southeasterly toward Wilson Creek and Jonathan Dickinson State Park. Reengineering and relocating existing culverts under Bridge Road, installing stormwater treatment ponds, berms and other water control structures will provide attenuation and water quality treatment for this area.

### Surface Water – Estimated Costs

Costs associated with surface water use involve intake structures and pumping facilities, and are identified in Chapter 3 of the *DRAFT Consolidated Water Supply Plan Support Documen*t.

### Surface Water – Quantity of Water Potentially Available

Surface waters from the C-23, C-24, C-25 and C-44 canals are primary surface water sources for agricultural irrigation and inflows to the St. Lucie River and Estuary and Indian River Lagoon. The Loxahatchee River receives inflows from the C-18 Canal and several other tributaries. Significant surface water storage will be provided in the future through construction of the projects summarized previously. Development of operating protocols for these systems will determine increases in surface water availability. Water for natural systems from new projects will be reserved from allocation by the SFWMD. The volume of water that may be allocated from the remaining water by any specific user must be determined through the District's CUP Program.

### Surface Water – Implementation Strategies

The following are potential strategies developed in cooperation with the public that will be considered in the development of plan recommendations regarding surface water/environmental supply:

- Establish an initial water reservation for the Loxahatchee River to protect existing water used for protection of fish and wildlife, consistent with the restoration goal identified for the Loxahatchee River in 2004, pursuant to the MFL established for the Northwest Fork of the Loxahatchee River.
- Establish MFLs for the tributaries to the Northwest Fork of the Loxahatchee River (Cypress Creek, Hobe Grove Ditch, Kitching Creek and Loxahatchee Slough) by 2007, pursuant to the MFL established for the Northwest Fork of the Loxahatchee River.
- Review and revise the MFL and associated recovery plan for the Northwest Fork of the Loxahatchee River, as necessary, to be

consistent with established restoration goals and future water reservations by 2005.

- Complete construction of the Ten Mile Creek Project by 2006.
- Actively pursue authorization for the CERP Indian River Lagoon – South PIR, and construct the project to manage of freshwater flows to the St. Lucie River and Indian River Lagoon. Look for opportunities to accelerate land buying, including innovative methods such a transfer of development rights (TDR).
- Conduct a study of the feasibility of connecting the SFWMD's C-25 Basin with the St. Johns River Water Management District's C-52 and Upper St. Johns River Basin Project to identify the benefits and estimated costs of such a connection.
- Continue implementation of the Northern Palm Beach County Comprehensive Water Management Plan (NPBCCWMP) to address freshwater flows to the Loxahatchee River.
- Complete the CERP North Palm Beach County Project Part 1 PIR, and implement the findings of that report, as a continuation of the NPBCCWMP.
- Develop a restoration plan for the Loxahatchee River that incorporates environmental water needs, while maintaining appropriate levels of flood protection.
- Complete construction of the CERP to address and minimize regulatory water releases from Lake Okeechobee to the St. Lucie River.

## Surficial Aquifer System

The Surficial Aquifer System (SAS) is the predominate source of water for public water supply and urban irrigation in the UEC Planning Area. The Surficial Aquifer is easily recharged from the surface. Wellfields using the Surficial Aquifer can be limited by the rate of recharge and water movement in the aquifer, environmental impacts, proximity to contamination sources, saltwater intrusion and other existing legal users in the area.

The analysis from the 1998 Plan has shown that expansion of Surficial Aquifer withdrawals in the coastal areas of the UEC Planning Area is limited due to potential impacts to wetlands, as well as the increased potential for saltwater intrusion. Additional withdrawals from the Surficial Aquifer in these coastal areas will be evaluated on a project-by-project basis.

### Surficial Aquifer System Estimated Costs

The costs related to well construction for the Surficial Aquifer System are provided in Chapter 3 of the *DRAFT Consolidated Water Supply Plan Support Document*. The costs to develop the Surficial Aquifer include drilling the well, pumps and treatment facilities, if necessary. Drilling of a Surficial Aquifer well is a function of diameter and depth. Cost for a 200-foot well depth is estimated to range from $32,000 for a 10-inch diameter well to $57,000 for a 24-inch diameter well. The amount of water that can be withdrawn from an individual well is site specific and varies across the UEC Planning Area. Production from Surficial Aquifer wells can be limited by the geology of the area, the rate of recharge and water movement in the aquifer, environmental impacts, proximity to contamination sources, saltwater intrusion, well diameter, pump capacity and other existing legal users' withdrawals in the area. Typical production rates from Surficial Aquifer wells in the UEC Planning Area range from 0.30 MGD to 0.75 MGD.

Pumping costs vary depending on the volume of water needed. For example, the construction cost for a 1-MGD pumping system is estimated to be about $72,000 with an annual operation and maintenance cost of $28,000. The construction cost for a 5-MGD pumping system is estimated to cost about $132,000 with an annual operation and maintenance cost of $104,000.

There are additional costs for water treatment for potable uses. Many of the treatment facilities in the planning area use lime softening for Surficial Aquifer water. Treatment cost information is provided in Chapter 5 of the *DRAFT Consolidated Water Supply Plan Support Document*. Estimated lime softening costs for construction and operation and maintenance is $1.38 per 1,000 gallons for a 1-MGD facility to about $0.80 per 1,000 gallons for a 10-MGD facility.

Utilities are beginning to convert traditional lime softening facilities to enhanced lime softening and membrane softening due to the advent of more stringent drinking water standards. The cost advantages of lime softening are in operating and maintenance expenses, where costs are typically 20 percent less than for comparable membrane technologies. One significant advantage of membrane softening over lime softening is the effectiveness of membrane softening in removing organics that function as a precursor to the formation of disinfection by-products, such as trihalomethanes.

### Surficial Aquifer System – Quantity of Water Potentially Available

Based on the 1998 Plan analysis and information contained in **Chapter 3**, from a regional perspective, increases in production from the SAS along the coast beyond existing demands appears limited due to potential wetland impacts and saltwater intrusion. However, it was concluded as part of the analysis that some further development of the SAS could be accomplished in these areas at the local level through modifications to wellfield configurations and pumping regimes with respect to locations of wetlands and salt water. As a result, additional withdrawals from the SAS in these coastal areas have to be evaluated on a project-by-project basis.

### Surficial Aquifer System – Implementation Strategies

The following are potential strategies developed in cooperation with the public that will be considered in the development of plan recommendations regarding the Surficial Aquifer:

- Develop tools so that Surficial Aquifer modeling can be incorporated into the next five-year update of this Plan.
- The potential of using the SAS for new and expanded uses should be evaluated on a project-by-project basis.
- Water users should consider development of alternative water sources that reduce reliance on the SAS for meeting future demands, and apply for the AWS Grant Program.

## RELATED STRATEGIES

The District will continue to coordinate the 2004 UEC Water Supply Plan recommendations with other regional planning efforts, including development of the Lower East Coast Regional Water Supply Plan, the CERP North Palm Beach County Project Part 1 project, Ten Mile Creek Critical Restoration Project, Indian River Lagoon – South Project and others.

## UNIT PRODUCTION COSTS FOR WATER SOURCE OPTION DEVELOPMENT

Cost information has been provided throughout this chapter and in Chapter 3 and 5 of the *DRAFT Consolidated Water Supply Plan Support Document* that could be used to estimate the planning-level total cost for different capacities for each of the water source options. This cost information was presented using the same categories in order to provide comparable cost estimates. The water supply cost estimates allow a relative comparison of the total cost for each alternative considered.

To ensure this internal comparability, the following cost estimate categories were used:

- Capital cost (including well drilling cost, construction cost, equipment cost, land cost and engineering cost).
- Operation and maintenance cost (including energy cost).

Total costs, which account for all expenditures, are an estimate of life cycle costs and are a function of the total capital costs, the expected life of the constructed facilities, the time value of money and annual operation and maintenance costs. These cost estimates aid in comparing alternatives with differing economic characteristics.

This cost information was used to develop planning-level unit production costs for each water source option (**Table 20**). The unit production cost equals the total costs divided by water production, expressed in dollars per 1,000 gallons. For all source options, the 2002 federal planning rate of 5.875 was used. A 30-year fixed capital asset life was assumed and operating level of 70 percent of capacity was used. To arrive at the unit production costs over the 20-year planning horizon, the unused capital value at the end of the planning horizon (one-third of total capital value based on straight-line depreciation) was deducted from the expenditure-based costs. All costs are expressed in projected 2005 dollars.

Because these cost criteria were used in all economic calculations, the relative cost between source options is comparable. However, the unit production costs presented here are not necessarily directly comparable to unit production costs developed in other investigations. To be considered comparable, cost estimates must use the same economic criteria.

For most of the water source options, general assumptions were used to generate the unit cost information. These costs can be highly variable depending on the specific situations of users, as reflected in the cost ranges for some of the options. In addition, the availability of water was not considered. Water supply costs vary for a number of reasons including, but not limited to:

- Hydrogeologic and hydrologic conditions relating to the depth to the aquifer, the yield of the aquifer, water availability, degree of treatment required, etc.
- Economies of scale in spreading fixed costs over a larger volume of output.
- In an area of slow growth, a larger percentage of capacity can be utilized than in areas of more rapid growth.
- Depending upon the quality of the raw water and the nature of the end use, different levels of treatment are needed.

**Table 20.** Summary of Unit Production Costs for Water Source Options.

| Water Source Option | Water Production Range | Unit Production Costs[a] ($/1,000 gallons) |
|---|---|---|
| Conservation (Indoor) | Variable | $0.22 – $0.58 |
| Conservation (Outdoor) | Variable | $0.03 – $0.88 |
| Groundwater | | |
| Surficial Aquifer – Withdrawal Only | 3 – 20 MGD | $.03 – $.10 |
| Surficial Aquifer w/Lime Softening | 1 – 20 MGD | $.73 – $1.38 |
| Surficial Aquifer w/Membrane Softening[d] | 3 – 20 MGD | $.88 – $1.66 |
| Floridan Aquifer – Withdrawal Only | 3 – 20 MGD | $.07 – $.15 |
| Floridan Aquifer w/Reverse Osmosis[d] | 1 – 20 MGD | $1.60 – $2.15 |
| Reclaimed Water | Variable | $.40 – $2.20 |
| Seawater w/Reverse Osmosis | Variable | $1.71 – $8.77[b] |
| Storage | | |
| Aquifer Storage and Recovery | 2 – 5 MGD | $.44 – $1.05[e] |
| Reservoir (4 feet deep) | 6,000 acre-feet | $.21[c] |
| Reservoir (8 feet deep) | 12,000 acre-feet | $.18[c] |
| Surface Water – Withdrawal Only | Variable | $.03 – $.21[d] |

a. All costs are over a 30-year project life and are not discounted. Because of economies of scale, the lower cost represents cost per unit for the greater capacity.
b. Lower cost in range reflects a high degree of special site-specific circumstances.
c. Represents the cost based on physical volume. Per unit cost for water made available is highly dependent on operational regimes and land costs.
d. Assumes withdrawal from existing surface water source, such as a canal or existing surface water management system. Cost could be significantly higher if separate storage area is required.
e. Varies depending on treatment required.

# CONCLUSIONS

Overall, it is concluded that with continued diversification of supply sources, such as the use of the Floridan Aquifer and reclaimed water, the existing and future water demands of the UEC Planning Area can be met with minimal potential impacts. Increased conservation of all water sources could result in several million gallons per day of water savings. Existing water uses have maximized development of the Surficial Aquifer in the coastal areas such that increased withdrawals from the Surficial Aquifer are limited, and are not adequate to meet the growing needs of the UEC Planning Area during a 1-in-10 year drought condition.

The two primary uses of the Surficial Aquifer in the coastal areas of the UEC Planning Area are public water supply and landscape irrigation. For public water supply, the scenario that showed the most promise to satisfy projected demands was continued use of the Surficial Aquifer at current levels and continued development of the Floridan Aquifer to meet the growing needs for potable water. Conservation, primarily through

retrofits of plumbing fixtures in older housing was shown to have significant potential savings in water use.

For landscape irrigation, the scenario that showed the most promise to meet future needs was continued use of the Surficial Aquifer at current levels and continued development of reclaimed water to meet the growing needs for irrigation water. Additional withdrawals from the Surficial Aquifer for landscape irrigation may be possible on a project-by-project basis. Landscape irrigation savings could be increased with the installation of rain sensors on existing irrigation systems. Improvements to landscape irrigation systems resulting from urban mobile irrigation lab evaluations can also further reduce outdoor water use.

For irrigated agriculture, predominately citrus, the existing practice of use of surface water from the C-23, C-24, C-25 and C-44 canals, supplemented with Floridan Aquifer water, is sufficient to meet the existing and projected needs during a 1-in-10 year drought event. Changes in economic condition within the citrus industry have caused projections of increases in irrigated agricultural acreage in the 1998 Plan to be reassessed. Growth in overall agricultural demand from 2000 levels is not anticipated. Construction of storage reservoirs associated with the CERP Indian River Lagoon – South Project will enhance surface water availability and reduce reliance on the Floridan Aquifer. Implementation of voluntary best management practices identified by the citrus industry, continued conversion of seepage/flood irrigation systems to microirrigation and the use of the existing agricultural mobile irrigation lab can further reduce agricultural water usage.

The analysis indicates the Floridan Aquifer can support the additional projected demands without exceeding resource protection criteria. The relationship between water levels, water quality and water use needs to be better understood. However, based on limited historic water quality information and projected water levels, significant changes in water quality are not anticipated with the projected demands. Continued collection of data towards this end should lead to a better understanding of this relationship. Development of a model to predict potential Floridan Aquifer water quality changes in the future is needed, preferably in time for the next update of this Plan.

Freshwater discharges from the C-23, C-24, C-25 and C-44 canals to the St. Lucie River and Estuary and the Indian River Lagoon are problematic in maintaining a healthy estuarine system. High-volume, prolonged freshwater releases from Lake Okeechobee via the C-44 Canal have a dramatic effect on water quality and the health of the estuarine system. A MFL was established for the St. Lucie River and Estuary in 2002. To address problems due to excessive flows and to provide additional storage, the CERP Indian River Lagoon – South PIR has been completed and its incorporation into the *Water Resource Development Act of 2004 (*WRDA 2004) is being pursued. Construction of the CERP Indian River Lagoon – South Project and the Ten Mile Creek Critical Restoration Project will address regional storage and freshwater flows from the watershed; the CERP and possible modifications to the Water Supply and Environmental Regulation Schedule

will address freshwater discharges from Lake Okeechobee to the St. Lucie River via the C-44 Canal.

The Loxahatchee River has been significantly impacted by the creation and maintenance of the Jupiter Inlet, which has contributed to the displacement of freshwater wetland communities by estuarine species in the Northwest Fork. In addition, construction of the C-18 Canal and installation of drainage projects for agricultural and urban development have lowered water tables and reduced the amount of fresh water available to the Northwest Fork of the Loxahatchee River, significantly altering natural flow patterns.

The District, USACE and local governments are making progress in improving flows to the Loxahatchee River. The Northern Palm Beach County Comprehensive Water Management Plan was accepted by the SFWMD's Governing Board in May 2002 and is being implemented, in addition to recommendations in the *2000 Lower East Coast Regional Water Supply Pla*n. A minimum flow and level was established for the Northwest Fork of the Loxahatchee River in 2002. The District has purchased approximately 44,800 acre-feet of storage in the L-8 Reservoir in the southern L-8 Basin. Analysis is being undertaken through the CERP North Palm Beach County Project, Part 1 modeling initiatives to determine how much more storage will be needed in the future. Construction of the G-160 Loxahatchee Slough Structure in northeastern Palm Beach County was completed in January 2004. This $2.1 million spillway structure will provide essential freshwater flows to the Northwest Fork of the Loxahatchee River during the dry season and will also maintain a more natural hydroperiod within the slough. Construction of the G-161 Northlake Boulevard Structure began in 2004.

An initial water reservation for the Loxahatchee River will be established in 2004. By 2005, the existing MFL and associated recovery plan for the Northwest Fork of the Loxahatchee River will be reviewed and revised, as necessary, to be consistent with established restoration goals and future water reservations. Minimum flows and levels will be established for the tributaries to the Northwest Fork of the Loxahatchee River (Cypress Creek, Hobe Grove Ditch, Kitching Creek and Loxahatchee Slough) by 2007.